THEA-FDOT I-4 FRAME Integration Key Takeaways

- **Collaboration will augment and enhance** the Tampa to Orlando connected corridor

- Connected Vehicle (CV) deployment collaborations will **demonstrate the value of interoperability** for data acquisition, safety, and operations.

- **Enhanced regional traffic data** supporting real-time operational decision-making will improve **THEA's CV system**

- **Safety benefits will be leveraged and expanded**, including a new CV deployment of a rail-crossing safety application on 50th St.

THEA-FDOT I-4 FRAME
Integration Key Takeaways (cont.)

- **Utilize THEA owned and shared fiber optics communications to RSUs**, thus eliminating the need for costly cellular communications to devices.

- **Provide complete RSU coverage** on the Selmon Expressway.

- **THEA will have a lead role,** responsible for systems engineering, device/infrastructure procurement, contracting CEI, and project management.

- **The project is on-schedule** and is expected to be complete at the end of 2025.

- **I-4 FRAME project will serve as a foundation** for future technology-based collaboration amongst these and other regional agencies.

Background – THEA Connected Vehicle Pilot

- **One (of three) locations nationally awarded by USDOT in competitive process**

- **Phases 1-3 (2015 to 2020)**
  - Concept development, planning, systems engineering, participant recruitment, deployment, data generation and performance reporting

- **Phase 4 (2020 to 2022)**
  - Extension/continuation, integration of three automobile Original Equipment Manufacturers (OEMs) and a Tier-One OEM supplier, migration towards V2X, and communications spectrum impacts testing

- **Core System Elements**
  - 48 Roadside Units (RSUs)
  - >1000 Private Participants, "after-market" and OEM On-Board Units (OBUs)
  - 9 Streetcars, 10 Buses
  - Ave 1.7 Million Basic Safety Messages per day
  - Ave 270 Participants per hour during AM Peak

Background – THEA Connected Vehicle Pilot (cont.)

- ~ 1 square mile system area

- Needs focused with corresponding use cases

- 9 safety-focused CV applications

- Lots of valuable lessons learned

THEA CV Pilot Results and "Stats" Snapshot

Combined Phases

- 17 Potential Crashes were Prevented
- 21 Potential Pedestrian Crashes were Prevented
- 14 Wrong Way Drivers were Warned
- 19 Warning for Red Light Violation were Provided
- Over 5,200 Advisories were Provided
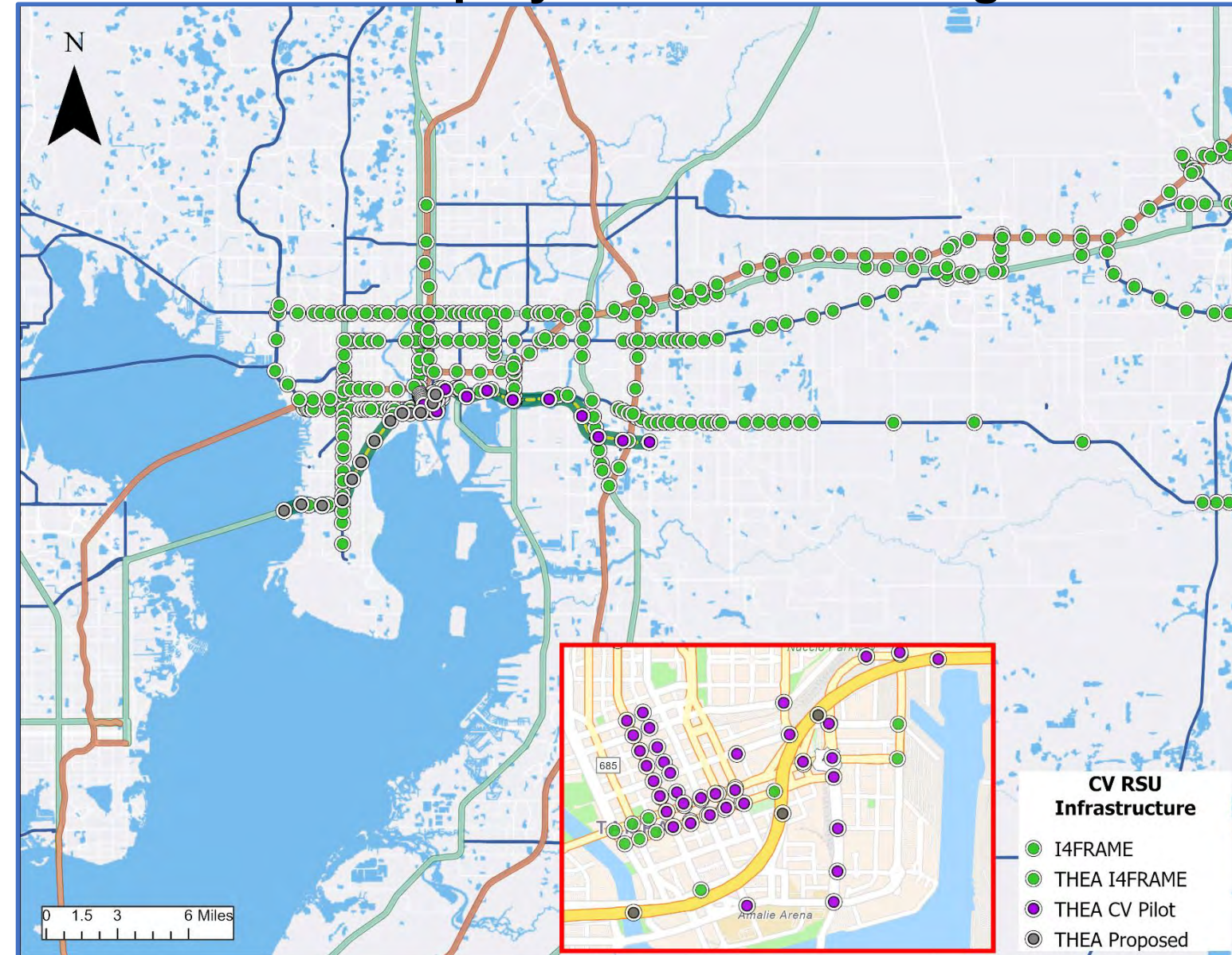
Overall Statistics

- 152,571 interactions between OBU-equipped vehicles
- 3.1 billion Basic Safety Messages (BSM)
- 26.4 billion Signal Phase and Timing Messages (SPaT)
- 3.4 billion MAP messages
- 71.9 million Traveler Information Messages (TIM)
- 22,147 V2V and V2I warnings

Validation that CV technology improves safety!

What's Next?

- CV works. How do we scale-up and expand benefits?

- Need partnerships! (e.g., FDOT I-4 FRAME, COT)

- Build on collective lessons learned, "continually do it better"

- Use "traditional" ITS to bridge future OEM V2X capabilities/features

- Recognize value of CV data for diversion, evacuation, traffic incidents and other emergencies

- Foster innovation, new use cases (e.g., Rail Crossing safety warnings, VRUs)

TAMPA HILLSBOROUGH EXPRESSWAY
AUTHORITY

CV RSU Infrastructure
- I4FRAME
- THEA I4FRAME
- THEA CV Pilot
- THEA Proposed

Florida CAV Business Plan

Florida's Connected and Automated Vehicles (CAV) Business Plan — January 2019

Seven (7) Areas of Focus

1. Policies and Governance
2. Program Funding
3. Education & Outreach
4. Industry Outreach & Partnerships
5. Technical Requirements & Specifications Development
6. Implementation Readiness
7. Deployment & Implementation

- Identifies and develops an institutionalized framework and timeframes to **aggressively move the CAV Program from research and pilot projects into statewide deployment** using expedited planning and outcome centric sustainable **safety, mobility, and innovation goals.**

The CAV Program has a roadmap with three (3) major phases:

2017-2018 Initialization	2019-2020 Early Implementation	2020+ Full-Scale Implementation & Operations

- Each of the seven focus areas are broken into subareas and are assigned a status (Planned, Underway, Completed, Recurring)
- Overall, **all seven focus areas are at least underway in the initialization phase**

FDOT — TSM&O — Transportation Systems Management & Operations

Florida CAV Program

Connected Vehicles

(CV) use vehicle-to-vehicle, vehicle-to-infrastructure, and infrastructure-to-vehicle communication to exchange information between vehicles, drivers, the roadside, bicyclists and pedestrians.

Projects/Initiatives

◆ Statewide Project/Initiative
◆ FDOT Led Projects
◆ Partner Agency Led Projects

Design/Implementation
1. I-4 FRAME (2019 ATCMTD)
2. US 90 SPaT Tallahassee (Phase 2)
3. US 98 Smart Bay
4. SR-710/Beeline Hwy - CAV
5. US 41 FRAME
6. Florida's Turnpike Mainline and Beachline CV Deployment
7. Lake Mary Boulevard CV Project
8. I-10 Smart Road Ranger
9. ◆ V2X Data Platform
10. US 1 Keys COAST
11. Railroad Advanced Notification System
12. I-4 Active Work Zone
13. LeeTran Traffic Signal Priority
14. Collier Countywide Connected Traveler Information System (CTIS)
15. Train Vehicle Crash Avoidance Pilot Project
16. Wildlife Protection
17. AWZM - District 2
18. AWZM - District 3
19. AWZM - District 6
20. CV Smart Signal - Lake County
21. SR 436 PedSafe Project - City of Altamonte Springs
22. SR-40 ITS Safety Deployment
23. Pasco County SMART US-19
24. Hillsborough County Connected Vehicle Priority and Preemption System
25. AWZM - District 7
26. Pedestrian Warning System – I2V Deployment along Alt 19 (City of Clearwater)
27. Smart Signal Corridor (West St. Petersburg)
28. ◆ RSU Health Monitoring
29. Cybersecurity
30. First Responder
31. U.S. 17-92 Connected Vehicle Deployment
32. Ped/Safe II U.S. 441/State Road 50

Planning
1. CV Bike Safety Pilot Deployments
2. State Road 423 Freight Signal Priority
3. Downtown Interchange Smart Work Zone
4. ◆ Pinellas County Smart Community (2020 ATCMTD)
5. SR-869/SW 10th Street Connector TSM&O SWZ
6. Smart St. Augustine
7. Intersection Collision Avoidance Safety Program
8. SR 60 West Coast Smart Signal Corridor Project
9. Connected Vehicle Priority and Preemption System (CVPP)
10. Bee Ridge Corridor Smart Signals
11. City of Sarasota CAV Project
12. SMART US 19

Operational
1. ◆ Security Credential Management Systems (SCMS)
2. ◆ Lane Closure Notification Systems (LCNS)
3. Gainesville SPaT Trapezium
4. ◆ Smart Signals Dashboard
5. ◆ AV Shuttles at Lake Nona
6. ◆ THEA CV Pilot
7. Smart Work Zone Trailer
8. Pinellas County SPaT
9. Incident Response Vehicle Pilot Project
10. I-75 FRAME Gainesville
11. SR 434 CV Deployment
12. ◆ Downtown Tampa Autonomous Transit
13. ◆ HART AV
14. ◆ AV Shuttle at PSTA
15. I-75 FRAME Ocala
16. Orlando Smart Community (2017 ATCMTD)
17. Seminole Expressway SWZ
18. I-4 Beyond the Ultimate South Smart Work Zone
19. Gainesville Bike and Pedestrian Safety
20. FTE SunTrax
21. US-1/Jupiter Bridge Smart Work Zone

Legacy/Retired
1. Near Miss Identification Safety System (N-MISS)
2. US 90 SPaT Tallahassee (Phase 1)
3. Gainesville AV Shuttle
4. Osceola County CV Signals
5. CAV Projects (ATMA)
6. CAV Tele-Operated Vehicle Phase 1 Research

FLORIDA MOVES
Connecting People for Safer Transportation
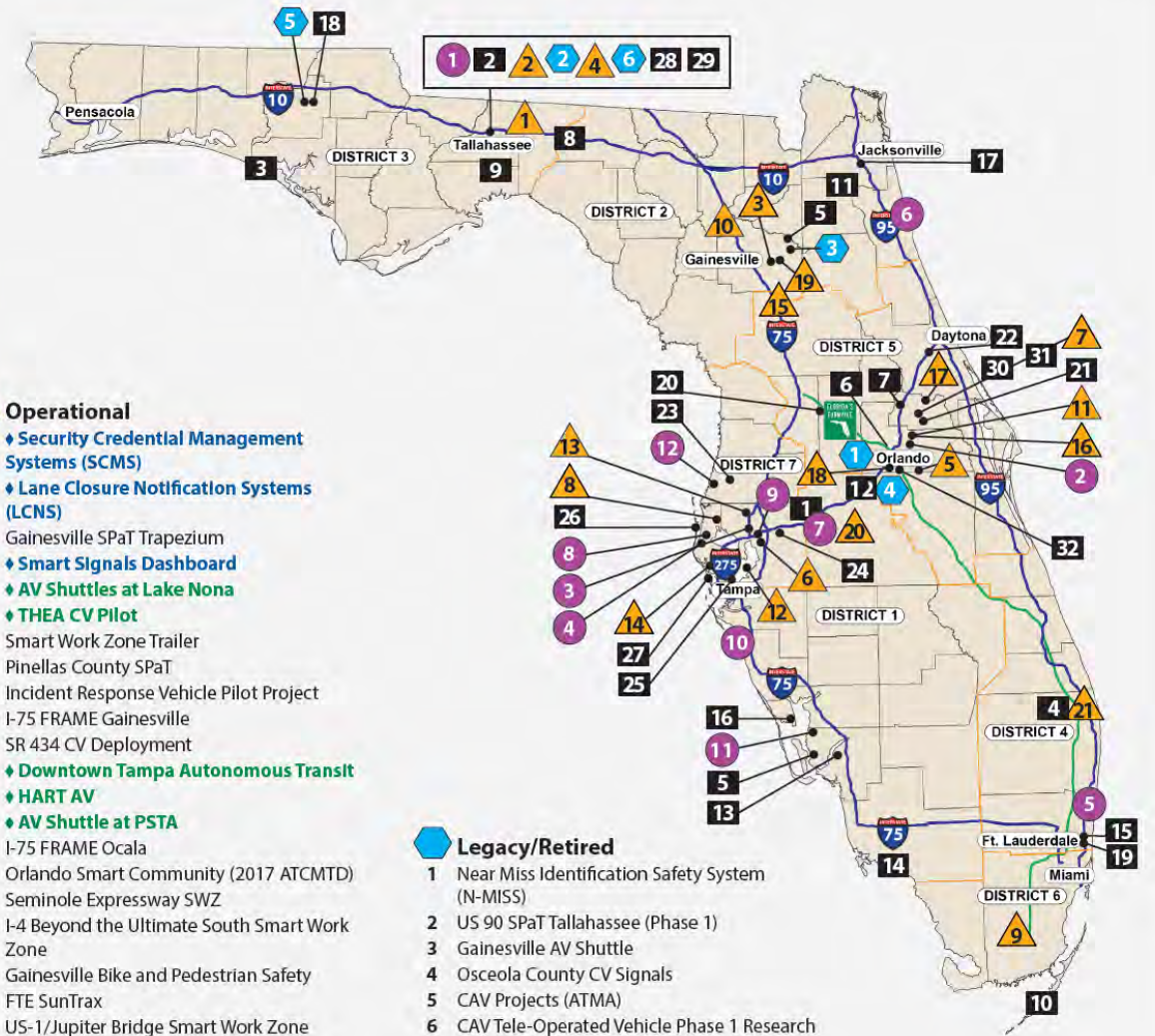
Presentation Outline

1. Promote I-4 Safety and Mobility

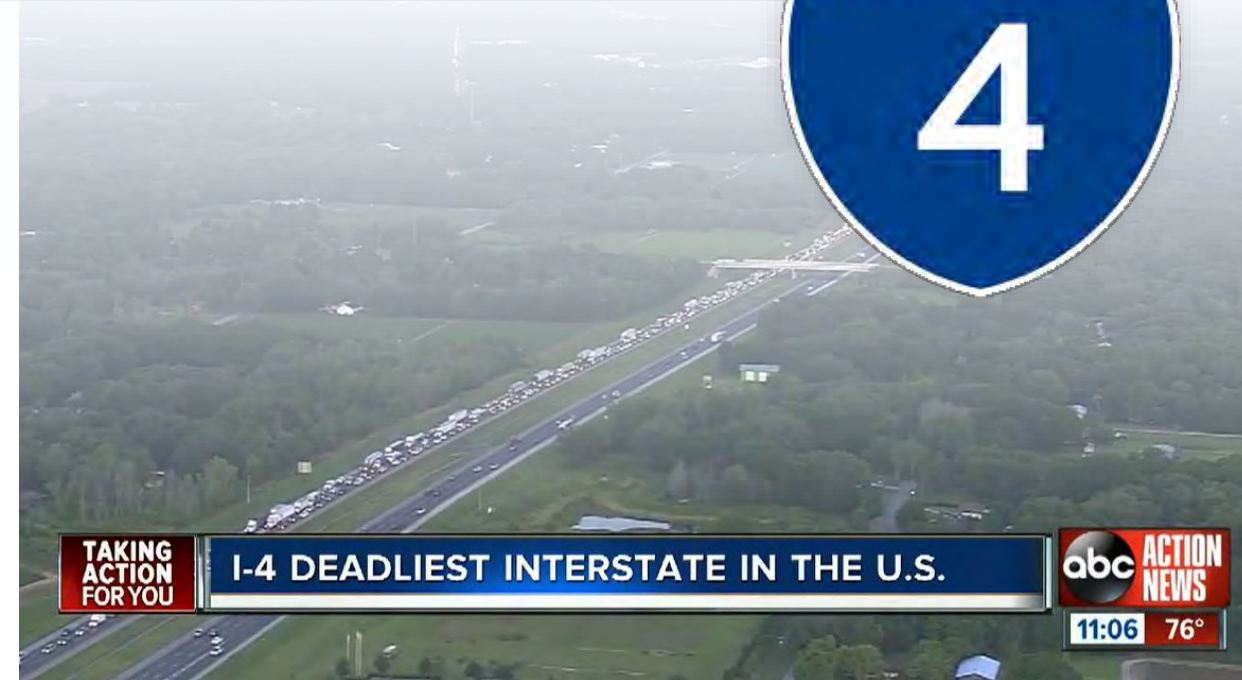2. Delivering I-4 FRAME

1

Understanding the Need for I-4 FRAME

Background

⚠ PROBLEM: High crash frequency (injury and fatalities)
Hinders Florida's Vision Zero Initiative

Orlando received 74 million annual visitors in 2023 and is America's most visited destination.

- I-4 experiences severe mobility issues due to frequent crashes and recurring congestion.
- Between 2019 and 2023, **106 fatal crashes** and **5,000 injury crashes**.
- For the Traffic Homicide investigation, the **average I-4 closure is 4 hours.**
- I-4 averaged **five lane-closure events per day with over 2,100 lane blocking events in 2023**
- One full directional closure every 4 days in 2023.

INTERSTATE 4

TAKING ACTION FOR YOU | I-4 DEADLIEST INTERSTATE IN THE U.S. | abc ACTION NEWS | 11:06 76°

Background: Crashes on I-4 from 2019 - 2023

Legend

Crash Heat Map
- High
- Low

— Interstate 4 (I-4)
— Primary Diversion Routes
-- Secondary Diversion Routes
— THEA Diversion Routes
— Florida's Turnpike Diversion Routes
- FDOT District 1
- FDOT District 5
- FDOT District 7
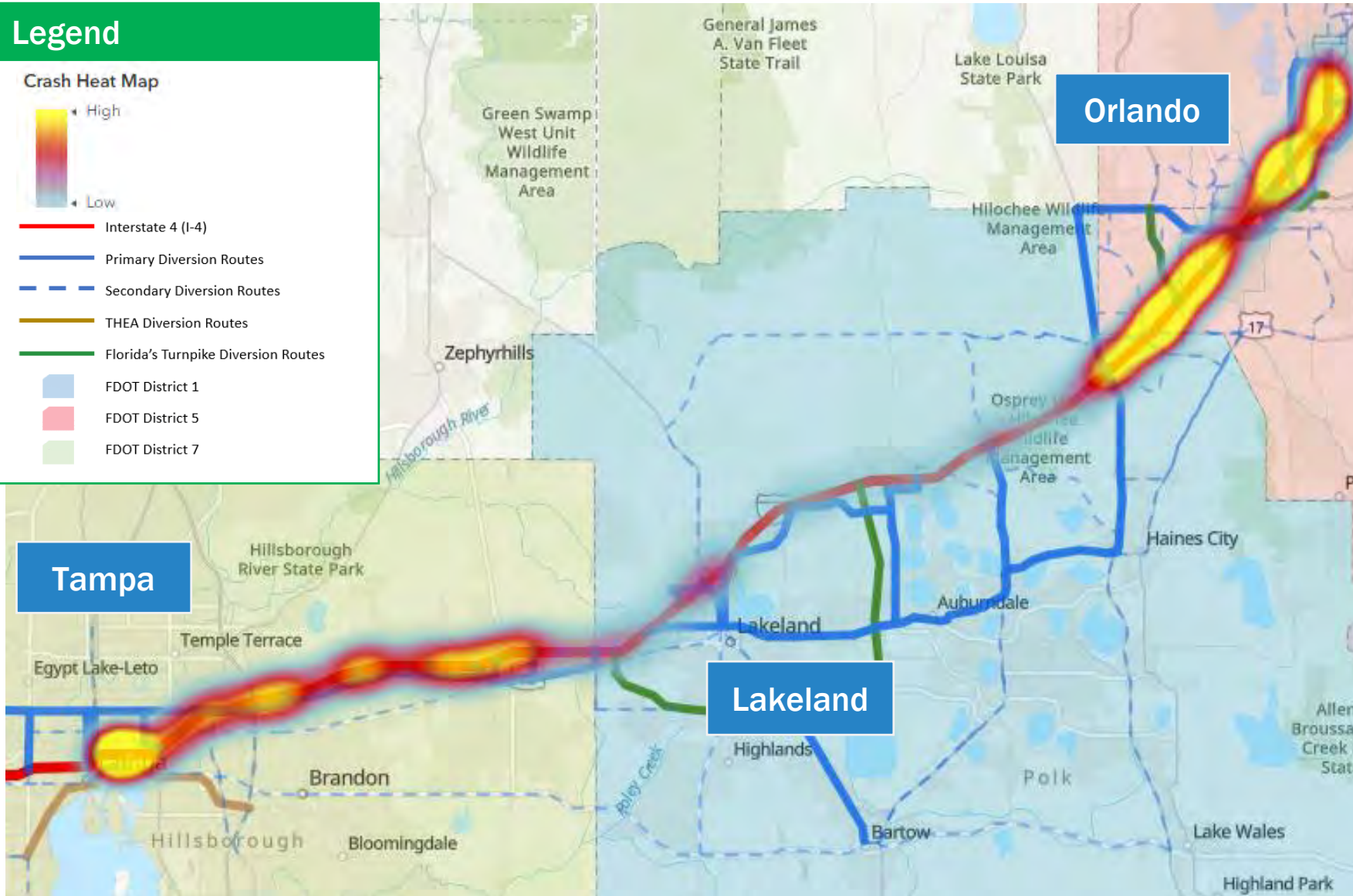
Crash Data

I-4 Crashes from 2019 – 2023 (All)						
Crash Severity	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
Fatality	18	18	32	22	16	106
Injury	1,078	845	1,158	976	943	5,000
Property Damage Only (PDO)	5,796	1,986	2,877	2,918	2,792	13,369
Grand Total	3,892	2,849	4,067	3,916	3,751	18,475

AADT = 142,000

Background: Major Incidents

Background : Major Incidents

Location: I-4 Eastbound at Championsgate

Event involved 20-25 gallons of roof sealant that spilled onto I-4. FDOT District 5 asset maintenance handled the event with District 1's asset maintenance support for maintenance of transportation (MOT) assistance.

Total event time: **3 hours 51 Minutes**

Location: I-4 Eastbound at Thonotosassa Rd

RISC event involving a jackknifed tractor trailer vs. vehicle crash.

Total event time: **1 hours 44 Minutes**

2 Delivering I-4 FRAME

- Goals
- Key Stakeholders & Coordination
- Project Design Overview
- Integration with Other Projects
- CV Hardware
- Project Schedule
- Lessons Learned

Project Development

I-4's history of congestion, incidents (and subsequent delays) **drove the initial ATCMTD Grant response and this current project's concept** →

Project Goals

- Implement **CV technology and Advanced Traffic Signal Performance Metrics (ATSPM)** throughout the I-4 corridor and adjacent arterials
- Utilize multiple **TSM&O strategies** by **deploying strategic CV-related devices and applications for better ICM practices**
- **Supplementary systems to be used, as appropriate, for immediate benefit**

I-4 FRAME
FLORIDA'S REGIONAL ADVANCED MOBILITY ELEMENTS
TAMPA — 4 — ORLANDO

Advanced Transportation and Congestion Management Technologies Deployment
VOLUME I: TECHNICAL APPLICATION

FDOT

2019 GRANT APPLICATION
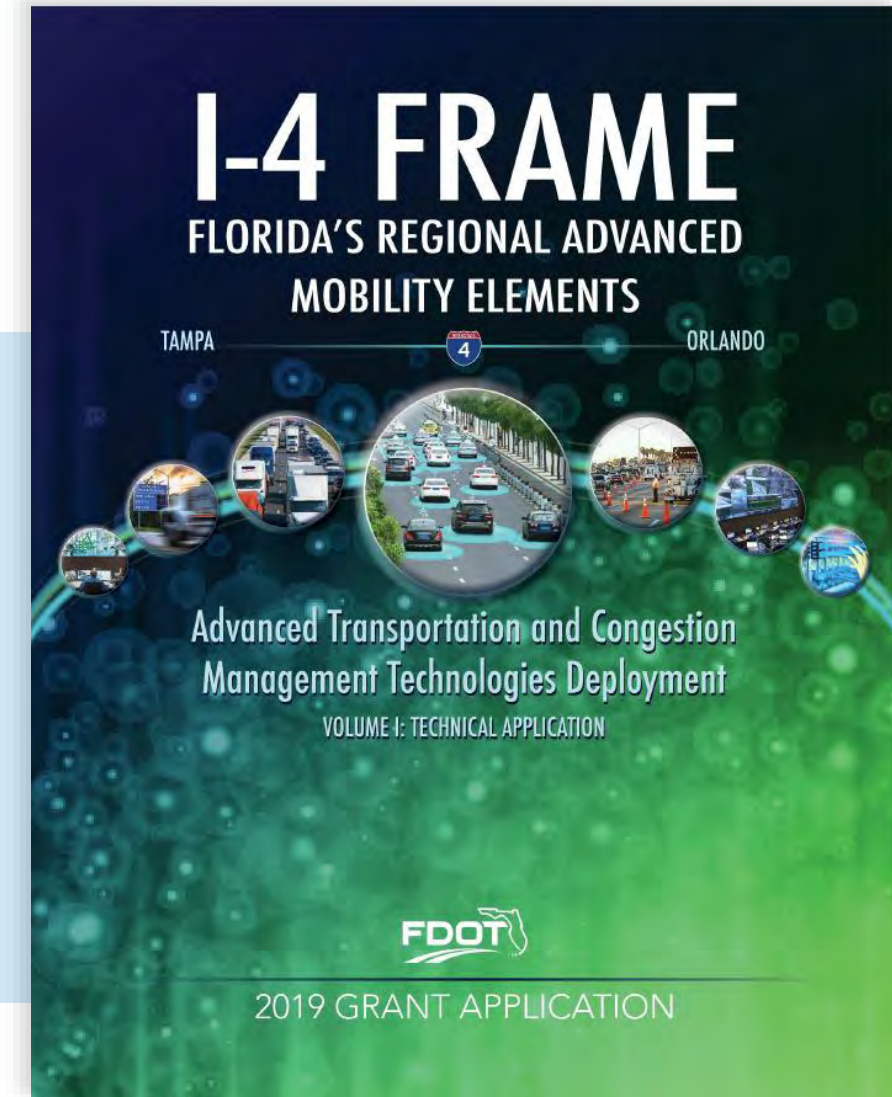
Improving I-4 Mobility

Freight

- Rail to Road Facility near Winter Haven
- 12% heavy commercial vehicles

Port

- High volume of freight out of the Port of Tampa Bay to Central Florida Distribution Centers

Construction/Work Zones

- Major reconstruction projects throughout project limits imminent (i.e. Tampa Bay Next, I-4 Beyond the Ultimate, etc.) with required detours onto the arterial network

I-4 FRAME Multi- Regional Project Overview

Legend

- ▬ Interstate 4 (I-4)
- ▬ Primary Diversion Routes
- ▬ ▬ Secondary Diversion Routes
- ▬ THEA Diversion Routes
- ▬ Florida's Turnpike Diversion Routes
- ▢ FDOT District 1
- ▢ FDOT District 5
- ▢ FDOT District 7

District 1

I-4: 30 miles
Arterials: 100+ miles

Florida Turnpike Roadways: 24 miles

District 7

I-4: 25 miles
Arterials: 80 miles
SR 60 CAV: 30 Miles

Florida Turnpike Roadways: 3 miles

THEA Roadways: 16 miles

District 5

I-4: 17 miles
Arterials: 30 miles

Florida Turnpike Roadways: 10 miles

Florida Turnpike Enterprise

Total Mileage Across All Districts

37 miles

Orlando

Universal Studios

Walt Disney World

Orlando International Airport

Florida Polytechnic University

SunTrax

Auburndale

University of South Florida

Temple Terrace

Busch Gardens

Citrus Park

Tampa

Plant City

Lakeland

Florida Southern College

Legoland

Winter Haven

Brandon

Tampa International Airport

Riverview

Mulberry

Bartow

Allen David Broussard

Project Development

75 Miles on I-4

275+ Miles of other limited access and signalized arterial roadways

Communications

- 20% Cellular/Wireless
- 80% Fiber Optic Cable

Cloud-Based through Application*

411 Signals
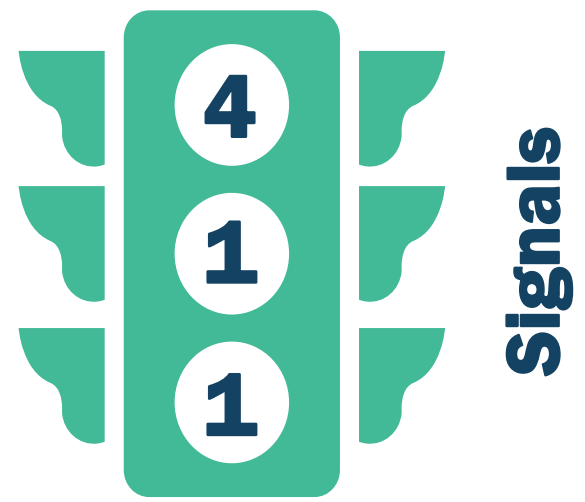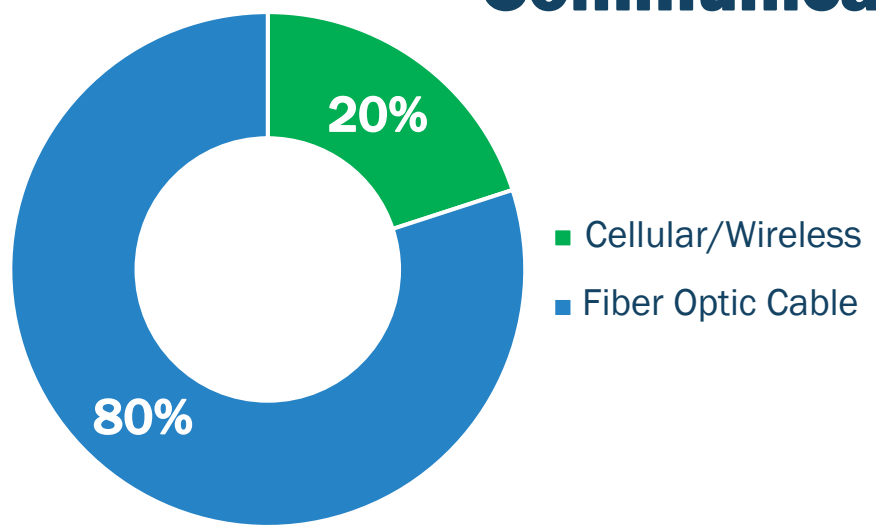
Goals

- **Deliver a project that supports Operations and overall CAV Business Plan**

- **Create a system design that is scalable and transferable that:**
  - Meets each Districts needs
  - Meets the goals of the CAV Program

- **Solve real-world problems (USE CASES) using TSM&O strategies which includes:**
  - CV Technologies
  - Diversion Routes

- **Identify performance measures**
  - Evaluate performance (Before/After) → University Research Partners to lead

- **Lastly → tie everything back to the USDOT initiatives/goals/objectives**

Key Stakeholders

Government
- FDOT District 7
- FDOT District 1
- FDOT District 5
- Florida's Turnpike Enterprise
- FDOT Central Office

MPO/TPO
- Hillsborough County MPO
- Polk TPO
- METROPLAN Orlando

Local Toll Agencies
- Tampa-Hillsborough Expressway Authority (THEA)

First Responders
- Florida Highway Patrol
- City Police Departments
- County Sheriff's Office
- Local Fire Departments

Maintaining Agencies
Counties
- Hillsborough
- Polk
- Osceola
- Orange

Cities
- Lakeland
- Winter Haven
- Plant City
- Tampa

Rail/Freight Port
- Rail to Road Facility in Winter Haven
- Port Tampa Bay
- Florida Trucking Association
- Additional Freight:
  - FedEx, UPS, DHL

Private Parties
- Publix (Lakeland HQ)
- Rooms-To-Go
- Walmart
- Amazon
- Rental Car Fleets
- Rideshare Companies (Lynx / Uber)
- Theme Parks
- Strategic Property Partnerships

Universities
- University of South Florida / CUTR
- Florida Polytechnic University
- University of Central Florida
- University of Florida

Local Transit Agencies
- Hillsborough Area Regional Transit (HART)
- Lynx
- Citrus Connection

25+ Stakeholders

Stakeholder Coordination

- **Create an I-4 FRAME Consortium**
  - Will act as the central group for all workshops, review of project documentation for input and approval

- **Early Stakeholder Coordination**
  - Creates buy-in
  - Workshops to discuss identified diversion routes and/or alternatives
  - Learn more about existing infrastructure and CAV readiness in each jurisdiction

- **Worked with Maintaining Agency Stakeholders to draft licensing agreements and Memorandums of Agreements**
  - Formalizing roles and responsibilities for the operation and maintenance of newly installed devices
  - Licensing agreements used for data sharing

I-4 FRAME Integration

- **I-4 FRAME District 7 Regional Integration with Other CV Projects**
  - Tampa ATMS
  - I-275 ICM
  - THEA

CV Technologies
Hardware
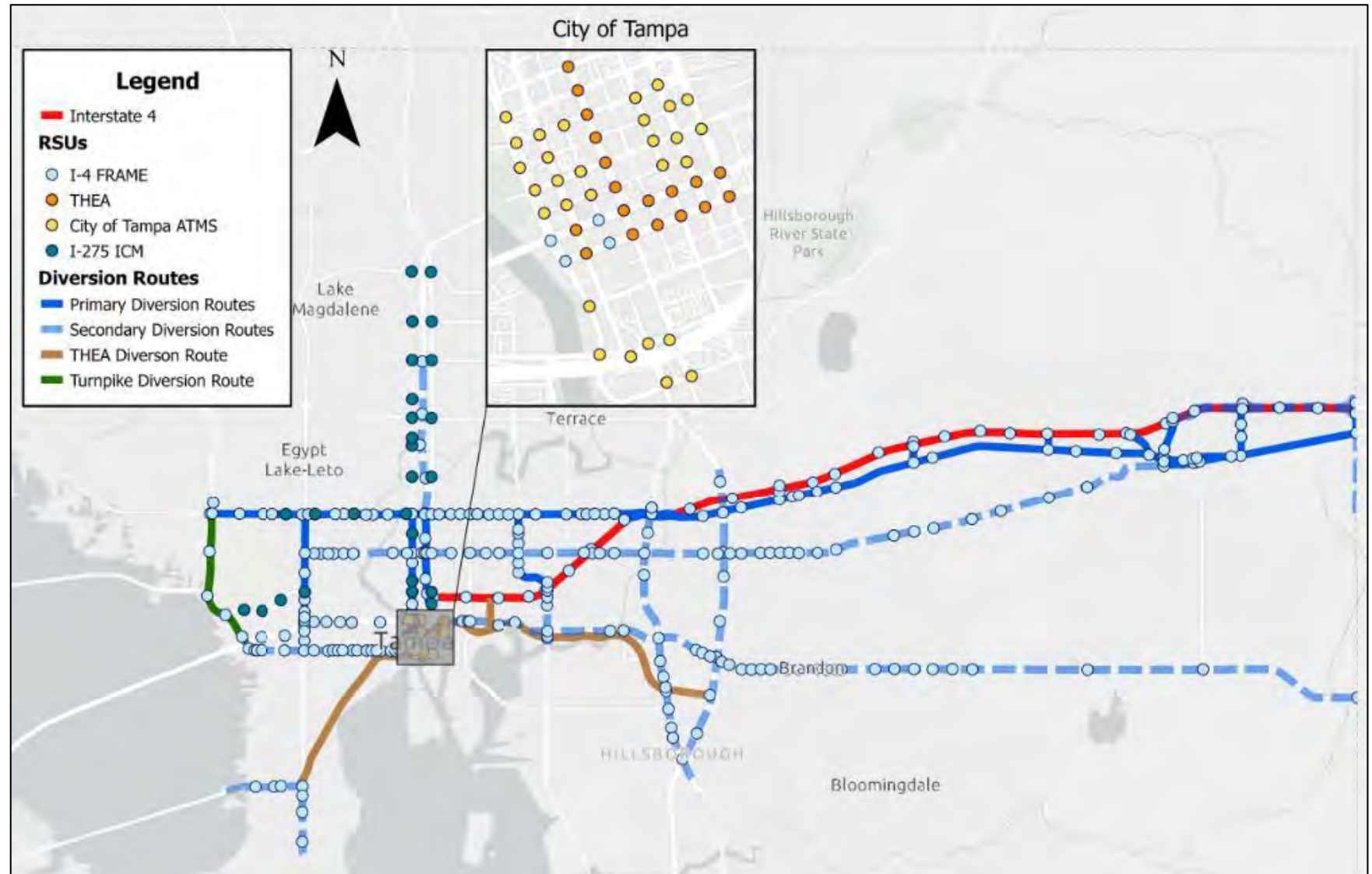
RSU
Roadside Unit

CV 541 RSUs
- Every Mile
- Dedicated Short-Range Communication (DSRC) and C-V2X capable

Roadside to Vehicle Messages for:
- Lane Closures
- Work Zones
- Delays, Congestion, & End of Queue
- Incidents
- Signal Phase and Timing (SPaT)
- Speeds
- Pedestrian-Bicyclist Safety
- Vehicle-to-Infrastructure (V2I)

OBU
Onboard Unit

CV 680 OBUs
- Public Vehicles
- Rental Cars
- Freight Companies (FedEx, UPS, DHL, etc.)

Advanced Traffic Signal Controllers
w/ATSPM

Replace approximately

220 controllers

Detection is required to make ATSPM work

Blank-Out Signs
Fiber Optic Multi-Faced

For Diversion Route

Evaluated routes based on existing demographics and roadway use

I-4 FRAME Project Schedule

Contract 1 - T7483
445362-2, 447012-1 (District 7)

- Construction Letting Date: 02.23.2022

- Construction Begin Date: 11.02.2022

- Est. Construction Completion: Fall 2024

Contract 2 - E7P15
445362-3, -4, -5 (District 1, 5, Turnpike)

- Construction Letting Date: 07.13.2022

- Construction Begin Date: 03.15.2023

- Est. Construction Completion: Summer 2025

FRAME Project	Contract Number	FPN	Current Time	Allowable Contract Time
Group 1	T7483	445362-2-52-01 447012-1-52-01	635	639
Group 2	E7P15	445362-3-52-01 445362-4-52-01 445362-5-52-01	518	796

Lessons Learned

- Ensure that local agency operations and maintenance personnel participate in design meetings – not just local agency design personnel

- Perform a full network review with local agency network personnel during design to ensure local agency understanding of proposed network
  - In particular, a clear understanding of what switches are being replaced and where

- Ensure inspection coverage over large geographic area

- Ensure that all parties understand firmware requirements for the signal controllers for connected vehicles

FDOT Compass
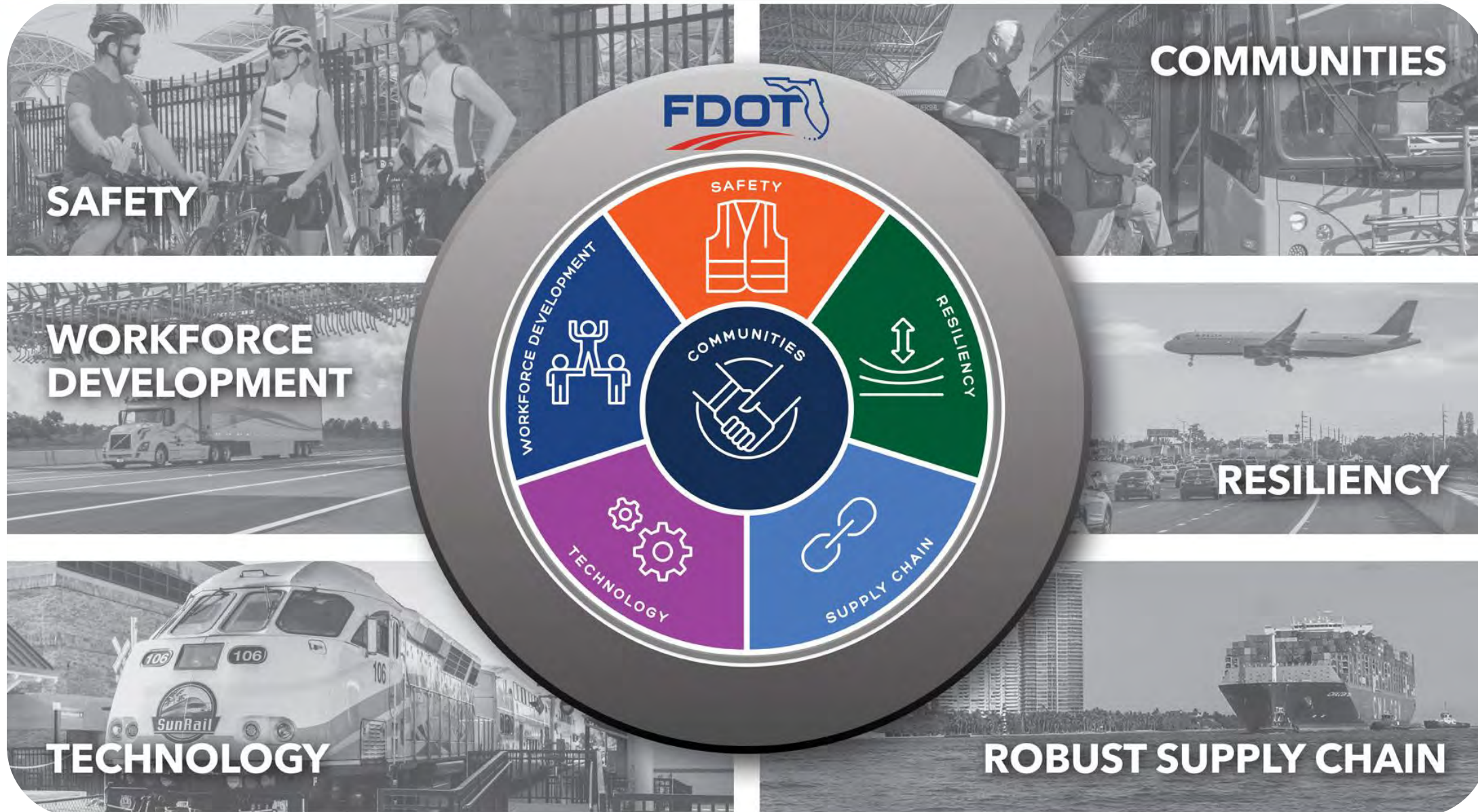
ATMS - Project History

Circa 1970 - Legacy Copper System

Need for capacity and quality in communication

- **2015 – Phase I (Westshore)**
- **2020-2024 – Phase II (Combined 2, 3, and 4)**

ATMS – **A**dvanced **T**raffic **M**anagement System
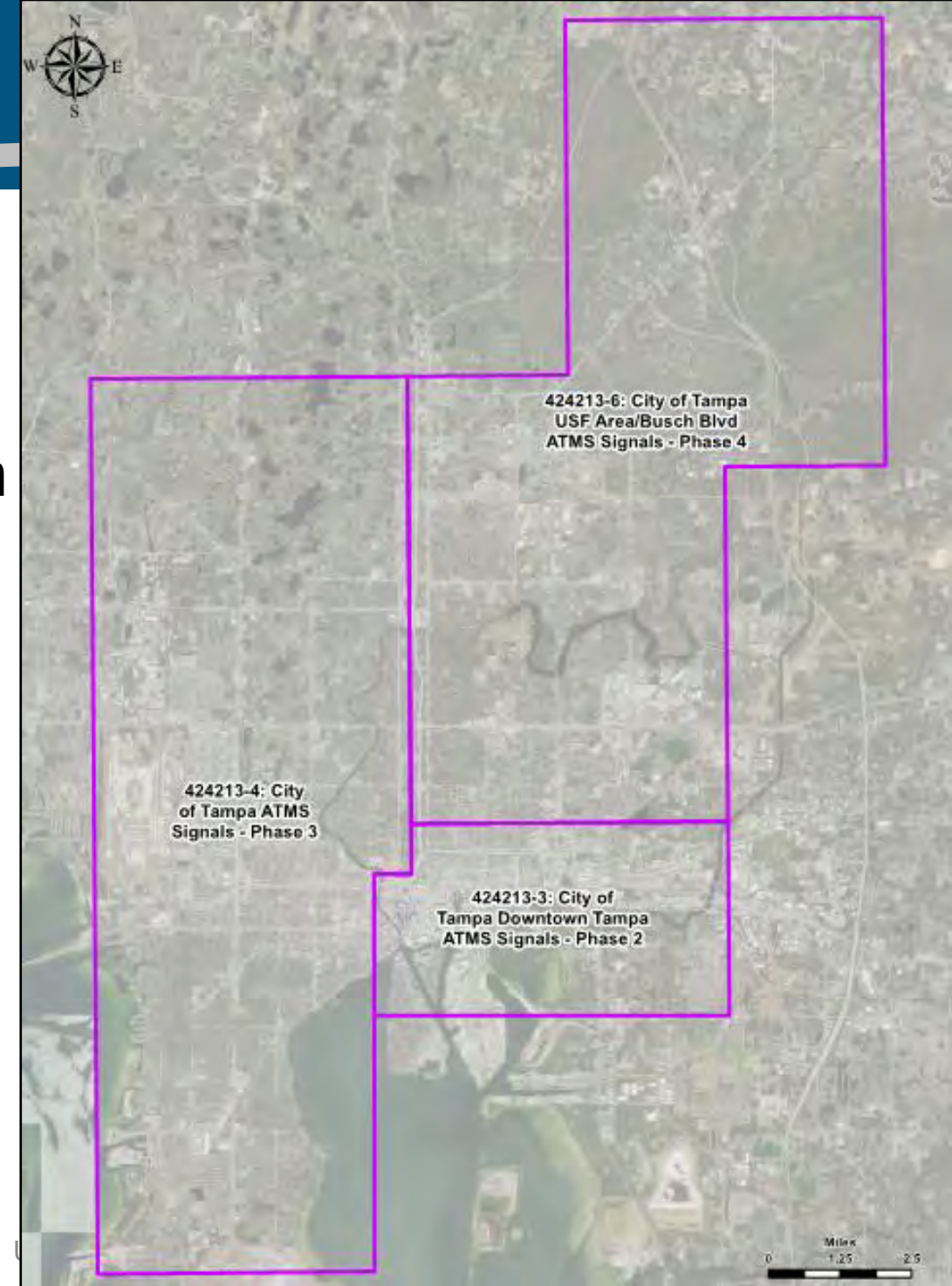
ATMS – Project Goals

- **Implement State of the Practice technologies**

- **Build for the Future**
  - **Create backbone for new technologies**
  - **Extend the reach**

Figure 14: CDMS Incidents vs WayCare Incidents
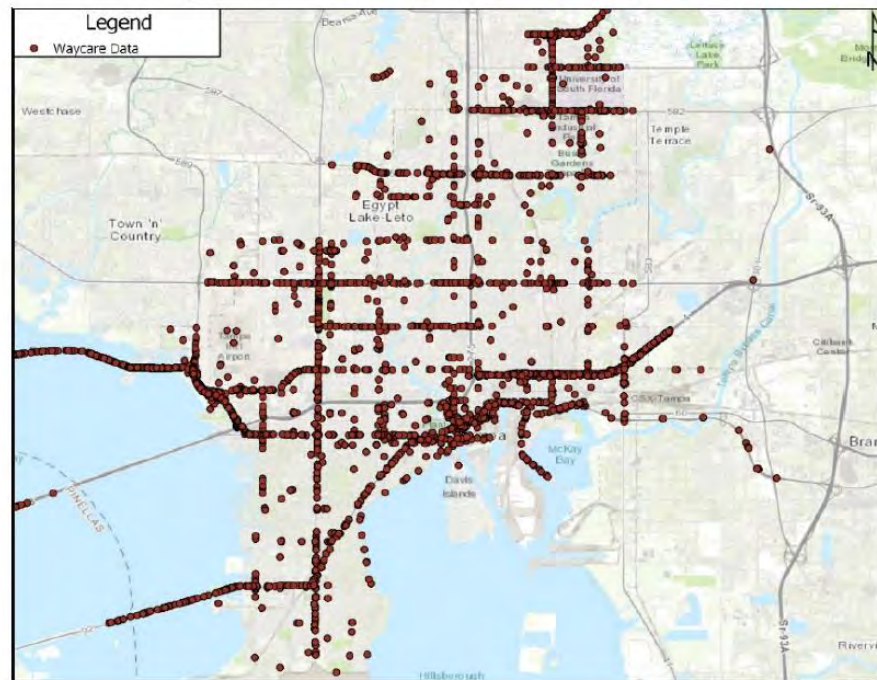
- Intersections
- Corridor Instrumentation

ATMS – Objectives

- **The project will provide foundational elements to prepare the City of Tampa as a SMART City in a connected transportation environment across all modes and all users.**

- **The project should reduce the long-term ownership costs and reduce the impact to the annual maintenance and operations budget.**

SMART – **S**trengthening **M**obility **A**nd **R**evolutionizing **T**ransportation

ATMS – Overview

- **Design-Build Project**

- **Collaboration between FDOT and City of Tampa**

- **Construction Completion:**
  - Scheduled - September 2023
  - Substantial - August 2024

- **Contract Amount: $38M**

Intersections

Conduit

Preliminary GIS Documentation
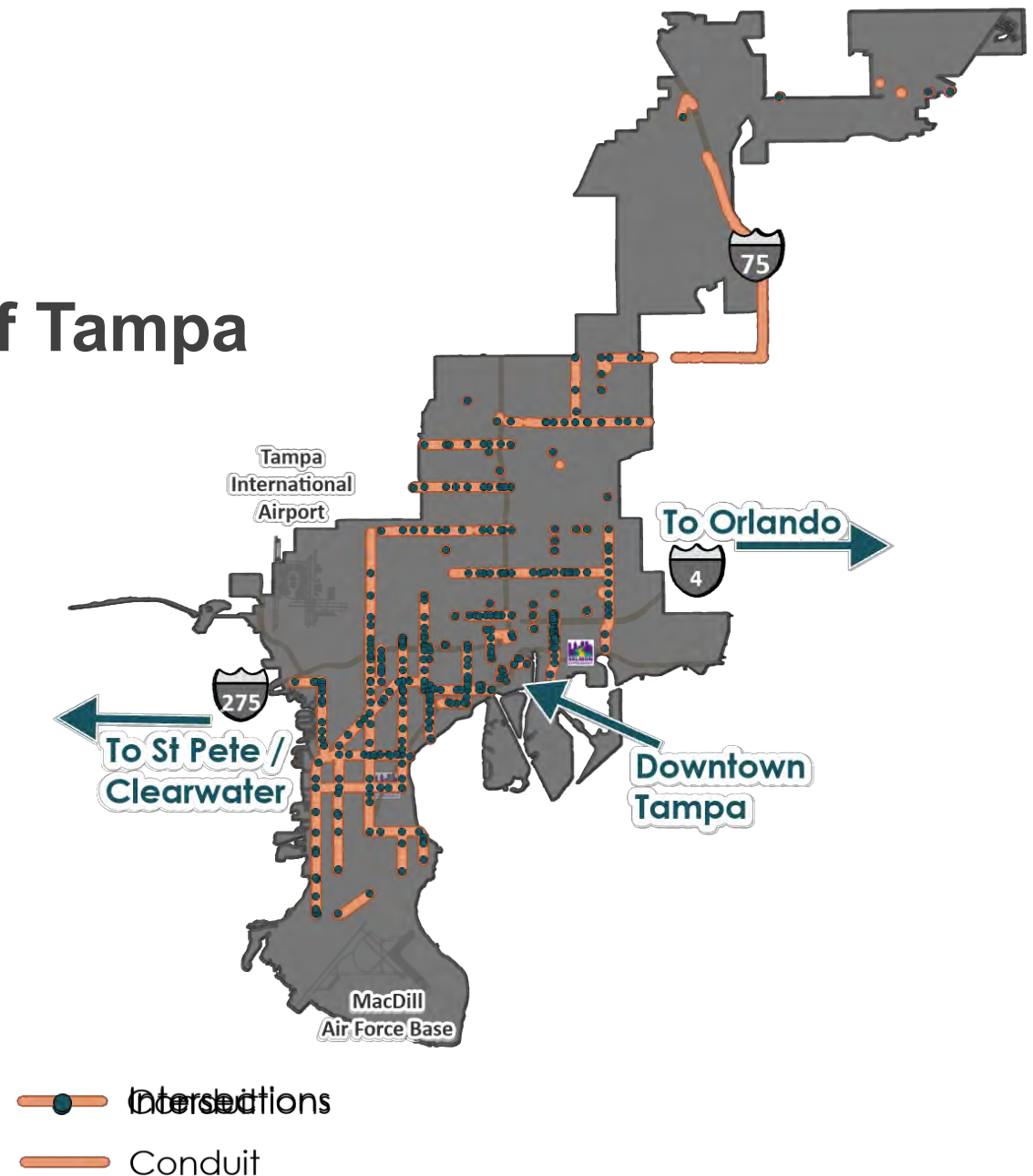
ATMS – Key Components

- **Communications System**
  - 458,000 LF of Conduit
  - 650,000 LF of Fiber
- **CCTV Cameras -** 63 intersections
- **Traffic Flow Sensors/Advanced System detectors -** 44 intersections
- **Roadway Flood Sensors -** 9 locations
- **Connected and Automated Vehicle Technology**
  - 40 DSRC radios / RSUs in Downtown Core
    - DSRC - Dedicated Short Range Communication
    - RSU – Road Side Unit
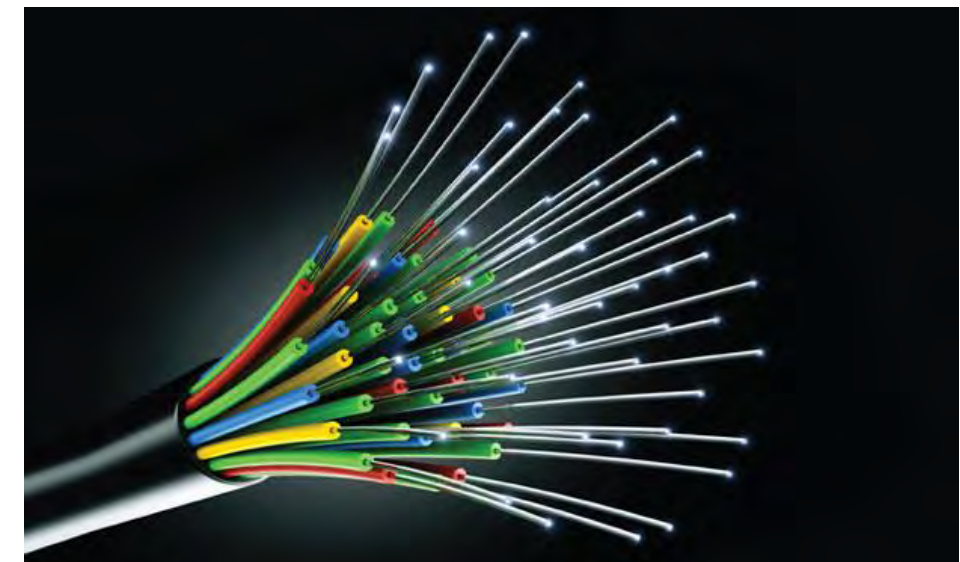
ATMS – Key Components

- **Traffic Signal System**
  - 355 New traffic signal controllers
  - 60 UPS (Uninterrupted Power Supplies)
  - Add Signal Performance Monitoring capability
- **Predictive Analytics**
  - Add Solution as a Service (cloud based)
  - Real-time traffic and Predictive Analytics
- **New City of Tampa TMC Equipment**
  - Replace servers, workstations
  - Replace fiber switches, firewall and routers

ATMS – Benefits

- **Modernize the outdated existing traffic management system**

- **Enhance the travel network throughout the City of Tampa**

  - Improve safety

  - Reduce congestion

  - Facilitate more travel choices

  - Improve signal network reliability

  - Provide capacity for partner agencies

- **Improve transit on-time reliability through signal priority**

TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY

THEA I-4 FRAME – What is
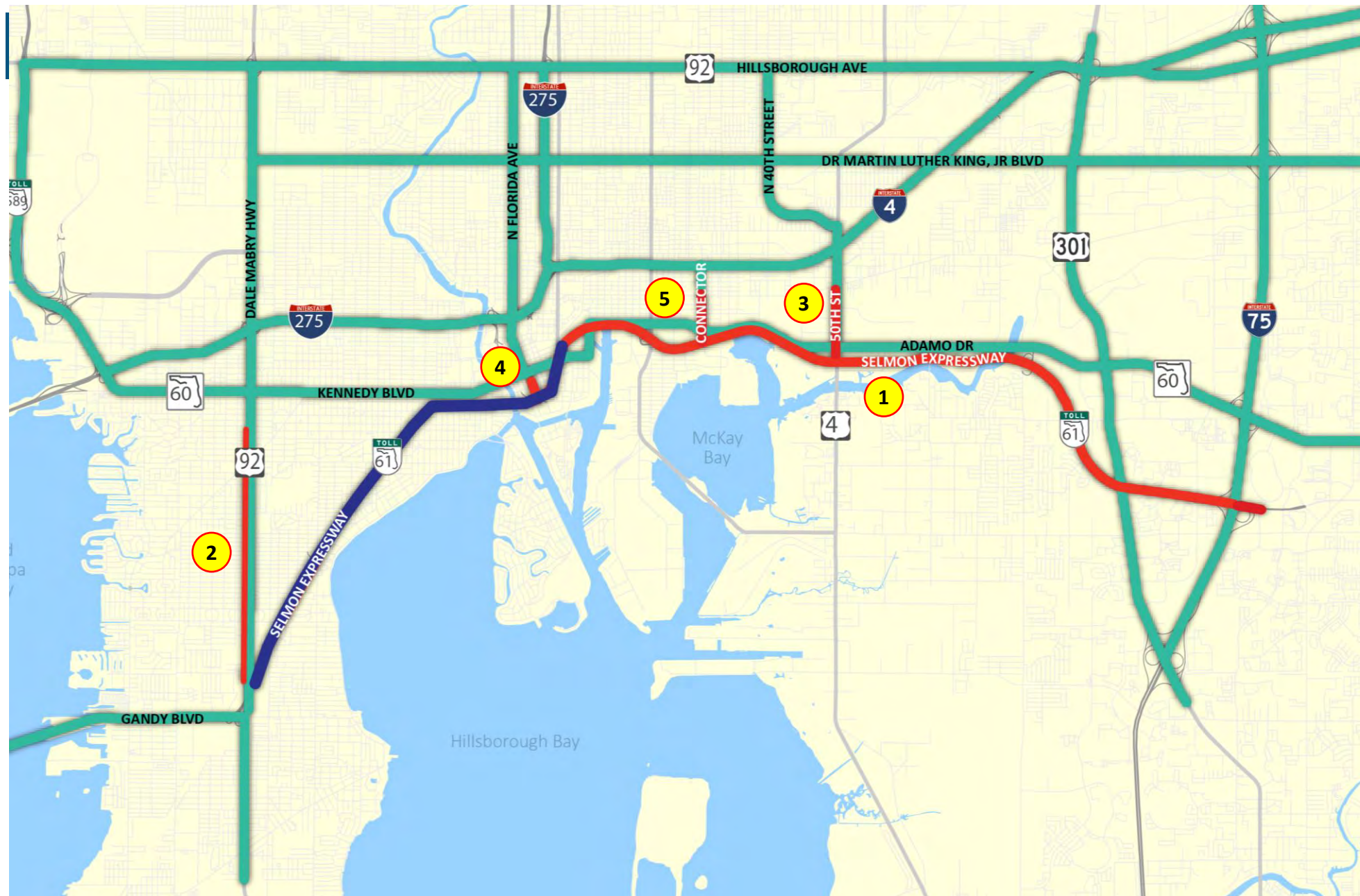
1 Selmon Expressway
- ☐ 18 New RSUs – complete coverage
- ☐ Existing Structures
- ☐ Existing THEA Cabinets, Fiber, Infrastructure

2 Dale Mabry Hwy – 10 Intersections
- ☐ 10 New RSUs – complete coverage
- ☐ Existing Signal Uprights
- ☐ Existing COT Traffic Cabinets, Tie into City Fiber Network, Infrastructure

3 50ᵗʰ Street – 2 Rail Crossings
- ☐ 2 New RSUs + 2 New Rail Cameras
- ☐ 2 New Device Poles with New Cabinets
- ☐ New Fiber Distribution Cable
- ☐ Existing COT Traffic Cabinet, Tie into City Fiber Network, Infrastructure

4 N. Florida Ave – 3 Intersections
- ☐ 1 New RSU
- ☐ 4 New Pedestrian Cameras
- ☐ Existing Signal Uprights
- ☐ Existing COT Cabinets, Fiber, Infrastructure

5 I-4 Connector
- ☐ 1 New RSU
- ☐ Existing FDOT High Mast CCTV Pole
- ☐ Existing FDOT Cabinet, Fiber, Infrastructure

Design Goals & Objectives

Demonstrate the Value of Interoperability for First Multiagency CV Deployment in Florida

Demonstrate Seamless Security Between Multiagency Systems

Demonstrate and Create Diversion Routes from I-4 & I-275 to the Selmon Expressway

Expand Safety Benefits including Use Case: Arterial Rail Crossing Safety

Promote Collaboration, Coordination and Shared Resources

Design Process & Considerations

Aggressive Design Schedule – 8 Months
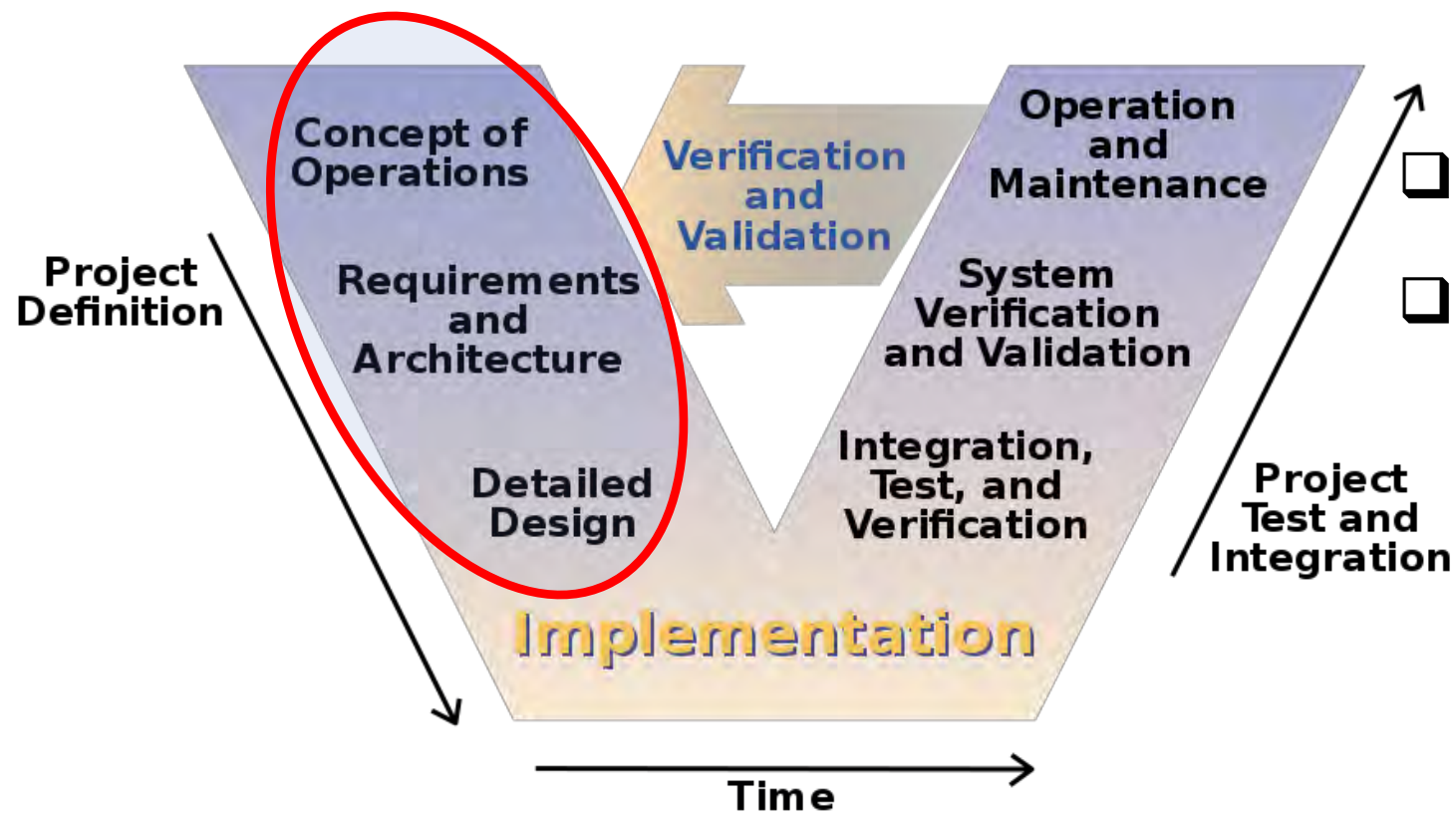
❑ Leverage Existing Infrastructure & Shared Resources

❑ Evaluation - Leverage Lessons Learned

❑ Coordination – *Overall Team Approach*

Designer

THEA, COT, FDOT

System Contractor

Network Integrator

❑ **Civil Contractor** (Sub to THEA Team)

Leverage Lessons Learned

1 **LESSON LEARNED**: <u>Standardized and Certified</u>

Design Solution # 1: Use Most Recently Published Standards -- CTI-4001 v01 (Supersedes DSRC v4.1), NTCIP 1218 , SAE J2735 and Others

Design Solution # 2: Certified by OmniAir (for Operations) and Other (for Environmental & Mechanical)

2 **LESSON LEARNED**: <u>Robust Network Performance</u>

Design Solution # 1: Fiber Connectivity for all RSUs & Ped Cameras

Design Solution # 2: Provide Edge Processing Capabilit
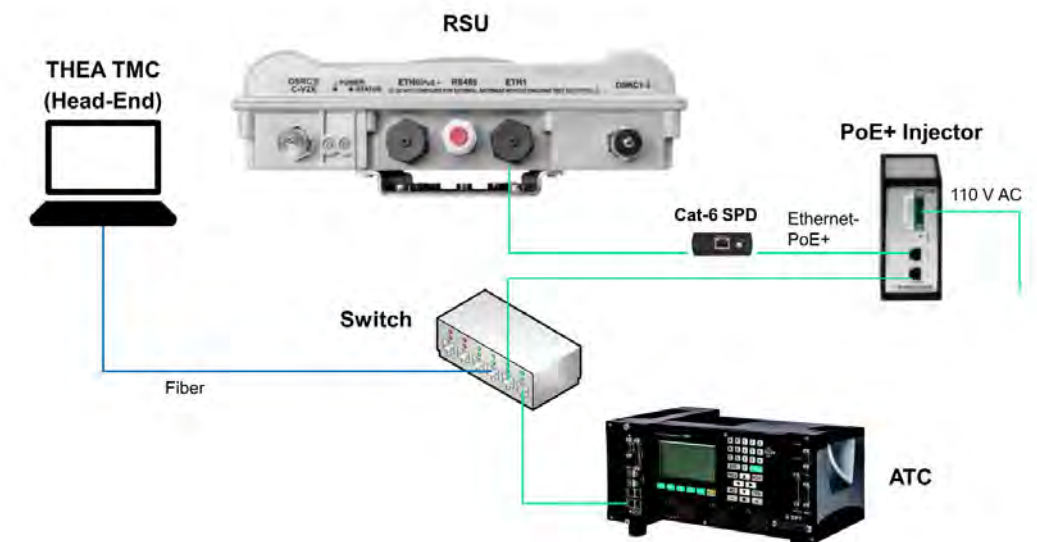
Leverage Lessons Learned

3 **LESSON LEARNED**: <u>Mitigate Weather & Interference Impacts</u>

Design Solution # 1: Lightning Attraction Mitigated By Electrically-Insulated Polycarbonate Housing

Design Solution # 2: Wind Load Issues and Salt Air Antenna Connector Corrosion Mitigated by Internal Antennas. IP67 rated external network connectors.

Design Solution # 3: Ensure that RSUs are Properly Grounded

Design Solution # 4: Mitigate Interference to Operations

HamWAN
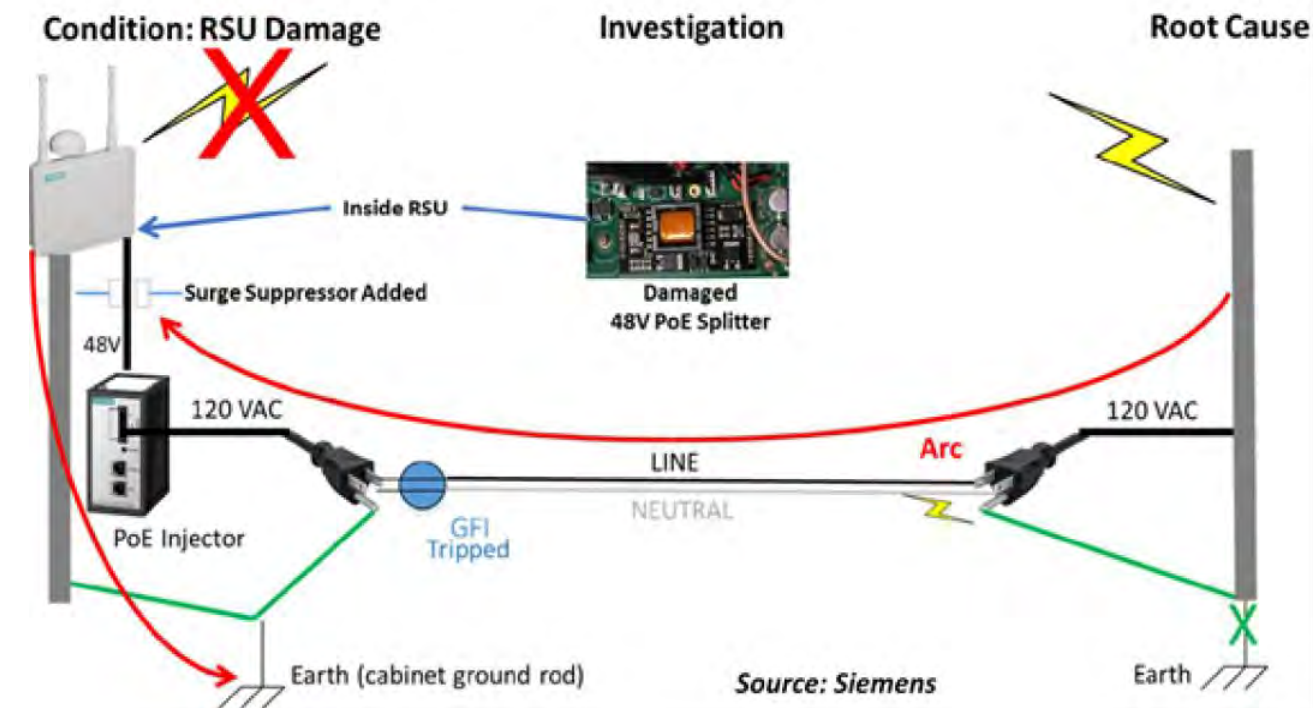
Leverage Lessons Learned

(4) **LESSON LEARNED**: <u>Consider the Entire Network & Security Posture</u>

Design Solution # 1: Ensure that RSUs Have Sufficient Computing Power

Design Solution # 2: Mitigate Security Threats

Design Solution # 3: Coordinate Network Resources and Security Protocols
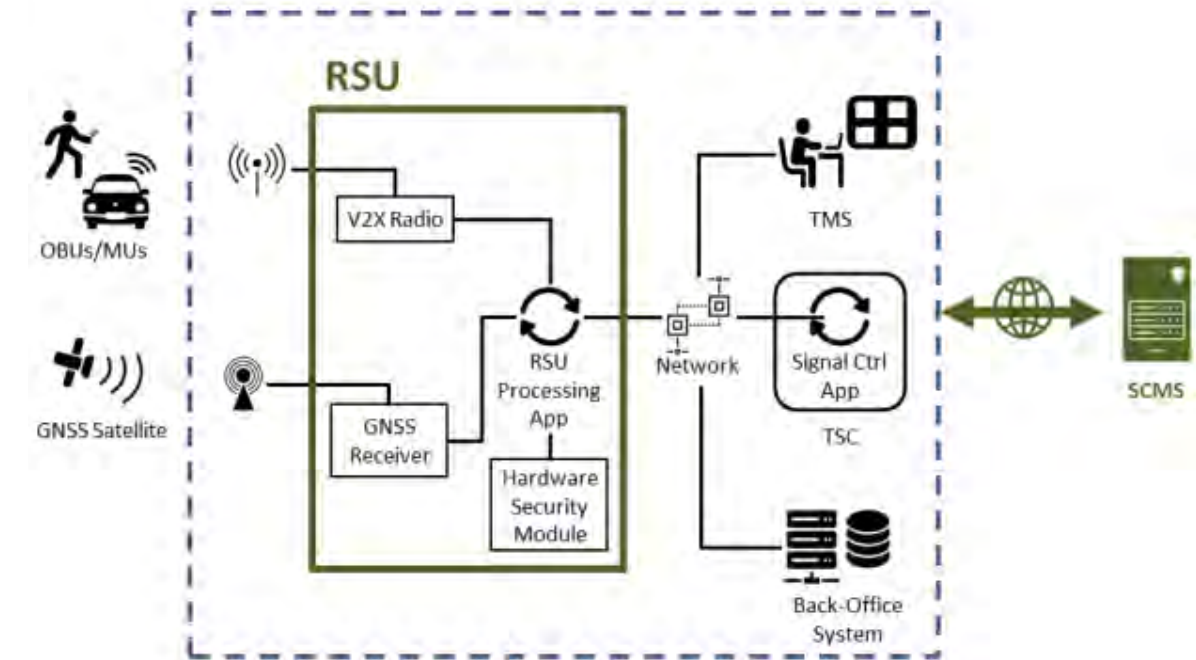
Leverage Lessons Learned

5 **LESSON LEARNED**: Optimize RSU Locations

Design Solution # 1: Develop Field Design Checklist to Optimize Placement and Locating of RSUs

- ❑ Collocation with Existing ITS/Traffic Signal Cabinets

- ❑ Collocation with Existing Poles/Structures

- ❑ Shared Conduit, Pull Boxes, Power, Network Equipment

- ❑ Mounting Height & Orientation – Verified w/ RSU Vendor

- ❑ Spacing Approximately ½ to 1-mile and at Ramps

- ❑ Clear Line-of-Sight (LOS) – Clear from Trees, Bridges, Overpasses and Other Structure

Pedestrian Detection

Vulnerable Road User Detection

OBU

Personal Safety Message
- Location
- Heading
- Speed
- Classification

RSU

Metadata
- Heading
- Location
- Speed
- Classification
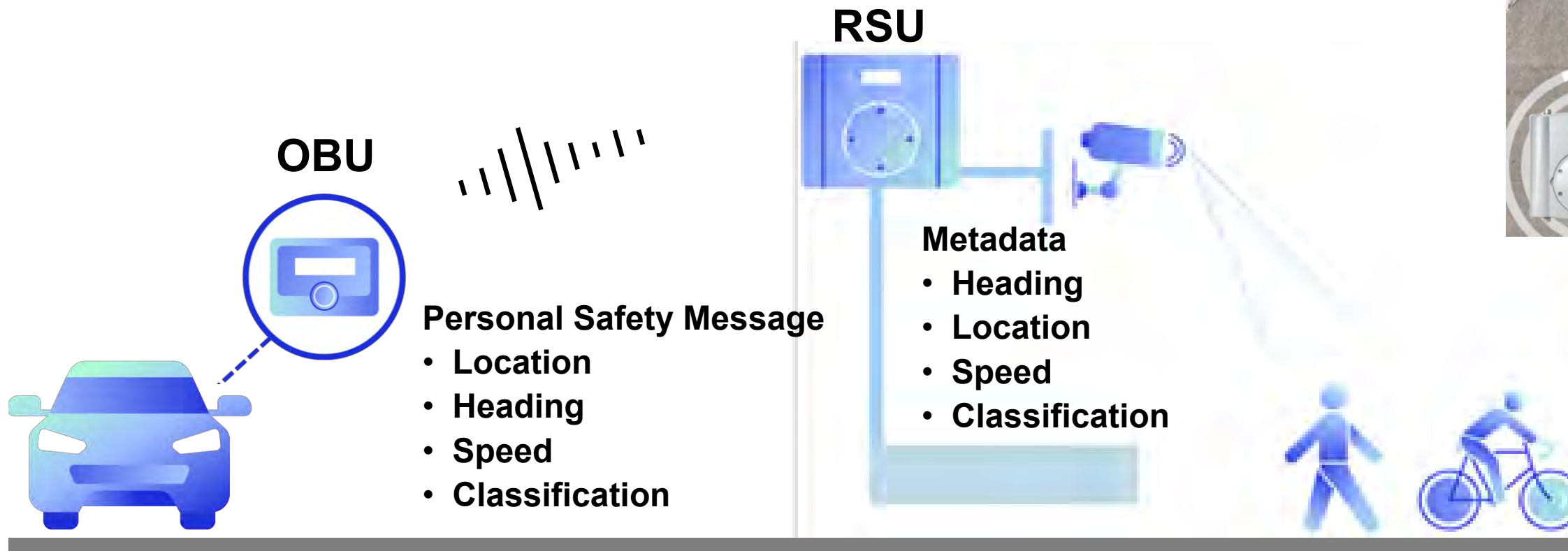
Cam Provide Metadata for Moving Objects

RSU App S/W Converts IS Metadata into SAE J2735 Standard Messages

Railroad Grade Crossings

50th Street Railroad Grade Crossings

North Crossing
27.955771, -82.401774

South Crossing
27.955771, -82.401774
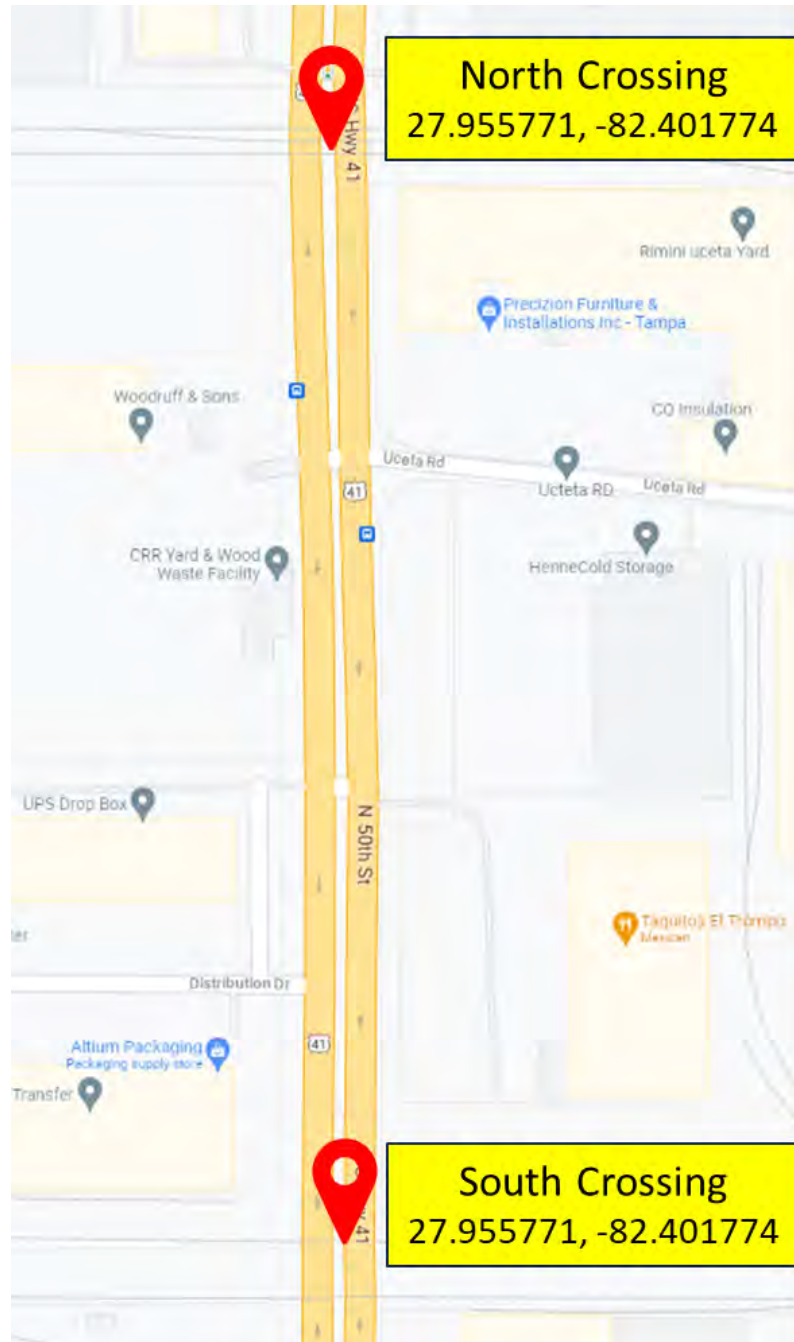
- **Equipped w/ RSU and Camera**
- **Camera FOV Include One Crossing Arm**
- **Camera Detects When Arm Horizontal**

North Crossing
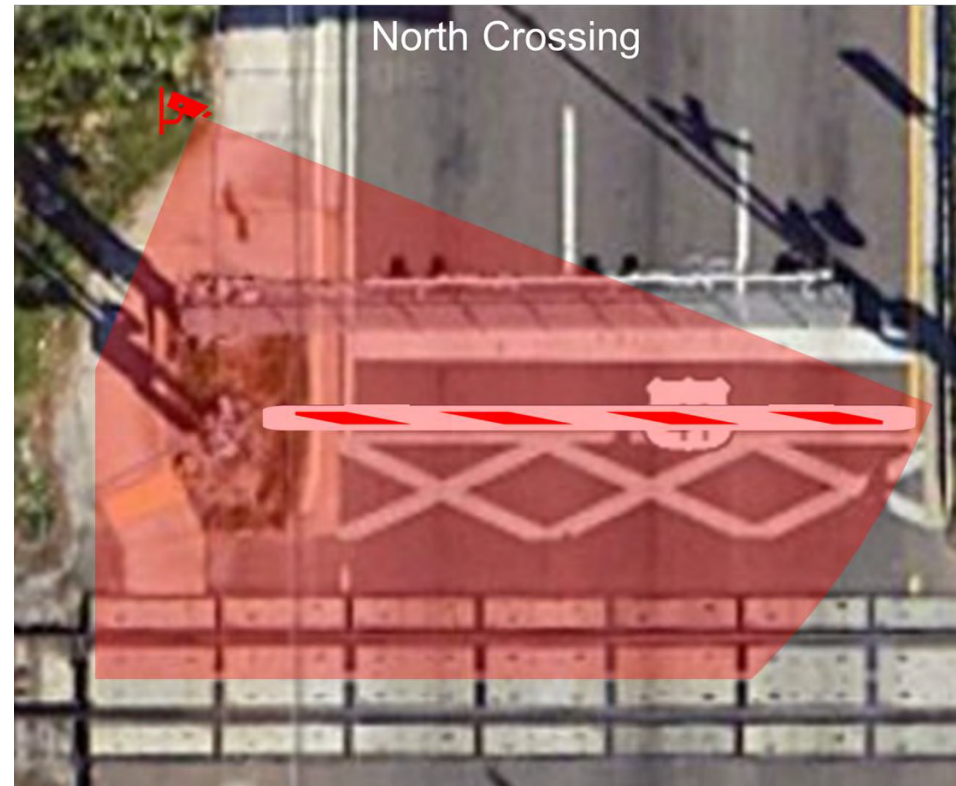
Support In-Vehicle Driver Displays

Passive: Always displayed to driver on approach | **Active:** Displayed to driver when is crossing active

W10-1

R15-1

IGM

WGM

Design Status

PROJECT STATUS:

- ❑ **Design:** Completed (July 2024)

- ❑ **SCMS:** All RSUs have been enrolled in 3rd Party SCMS

- ❑ **FCC Licensing:** FCC has Granted Experimental Licenses and Temporary Waivers to Operate on C-V2X CH183.

- ❑ **Product Approval:** RSU Tested by TERL and Received Written Acceptance

- ❑ **Implementation Phase:** Started

CV Data Management Benefits

- Centralized Storage and Access to Florida's CV Data
  - *Reduces Cost and Time Handling CV Data*
- Catalogs Data Elements
  - *Promotes Accessibility and Reusability of Data*
  - *Enables Further Research, Innovation, and Development*
- Defines Data Standards and Requirements
  - *Supports Successful Integration and System Operation*
    - Across multiple systems and device vendors
- Formalizes Data Quality Processes
  - *Maximizes Accuracy and Benefit from Decisions*
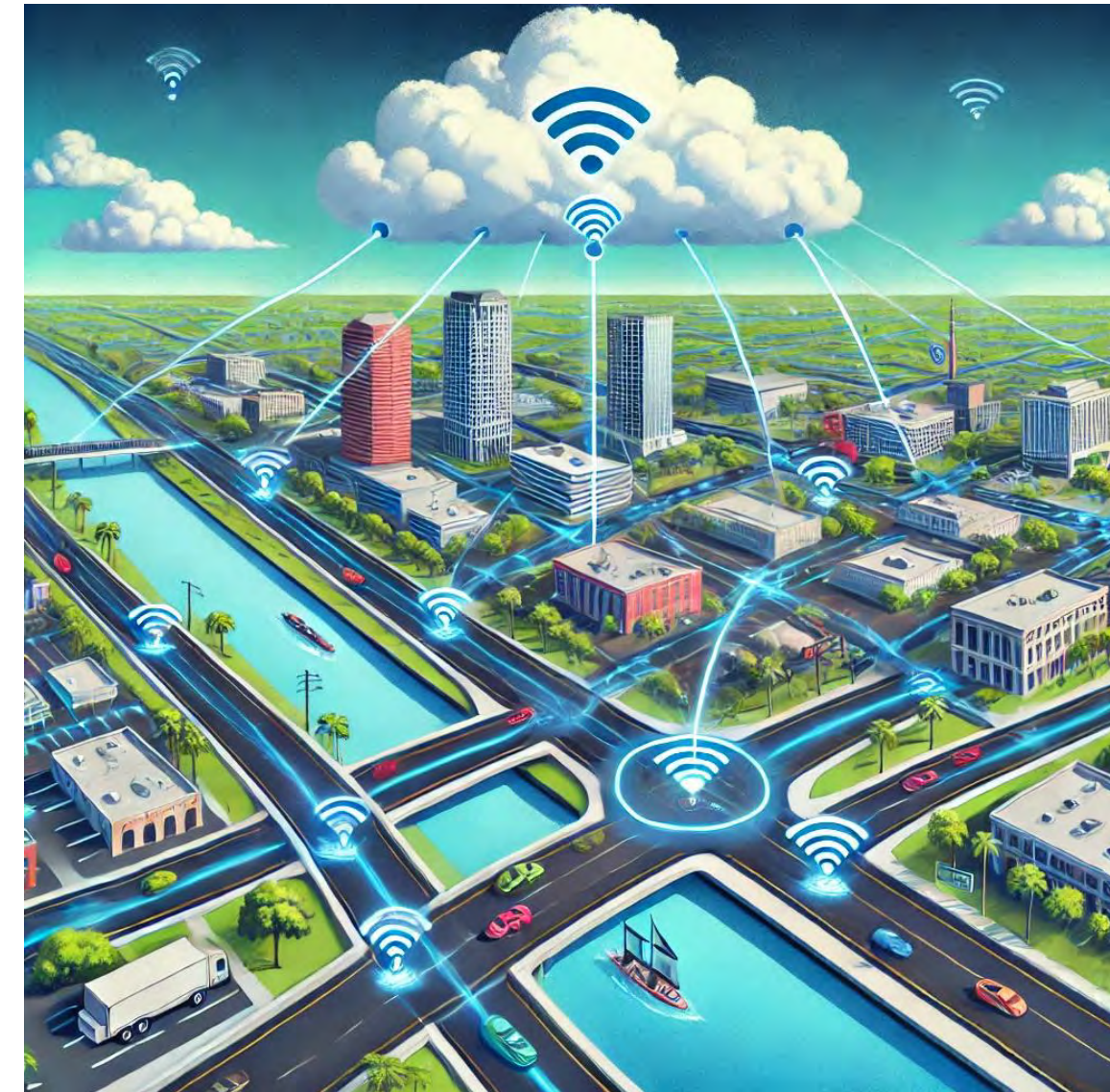
FDOT V2X Data Exchange Platform (DEP)

Implementation of Data Management for Florida's Connected Vehicle Program

- **Exchanges Data**
  - Florida's CV and ITS Deployments
  - Florida's TSMO Operations
  - Vehicle OEMs
  - Researchers/Developers
- **Manages Data**
  - Stores, Catalogs, Standardizes, and Formalizes Quality
- **Platform for Innovation**
  - Data Discovery
  - Analytics
  - Data Integration
  - Use Case Driven Externally Developed Applications

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FDOT V2X DEP In Action
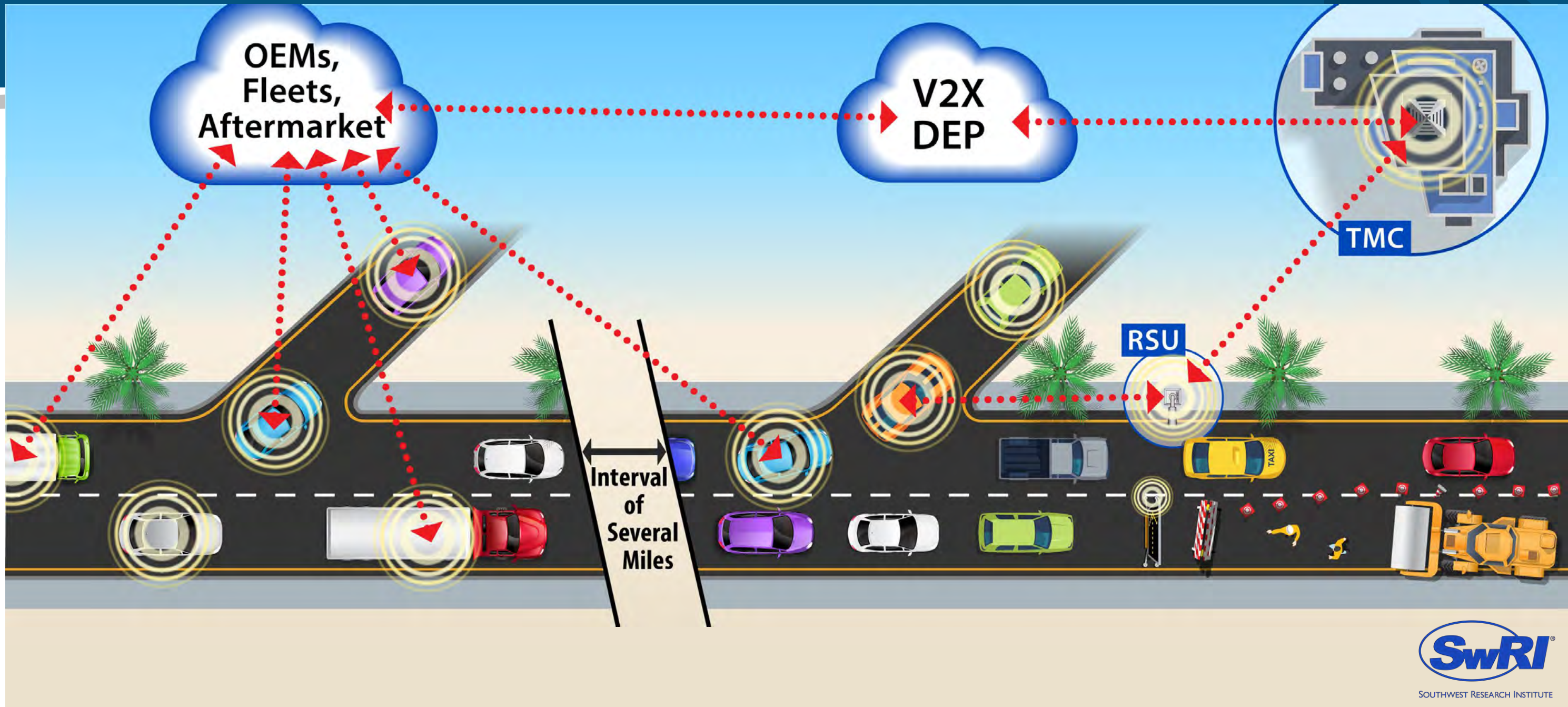
Fig. *DEP in Action* from *Transpo 2024* – Technical Track 5B – *We are Living in a Connected World,* Mike Brown (SwRI), 8/27/2024

FDOT V2X DEP Architecture
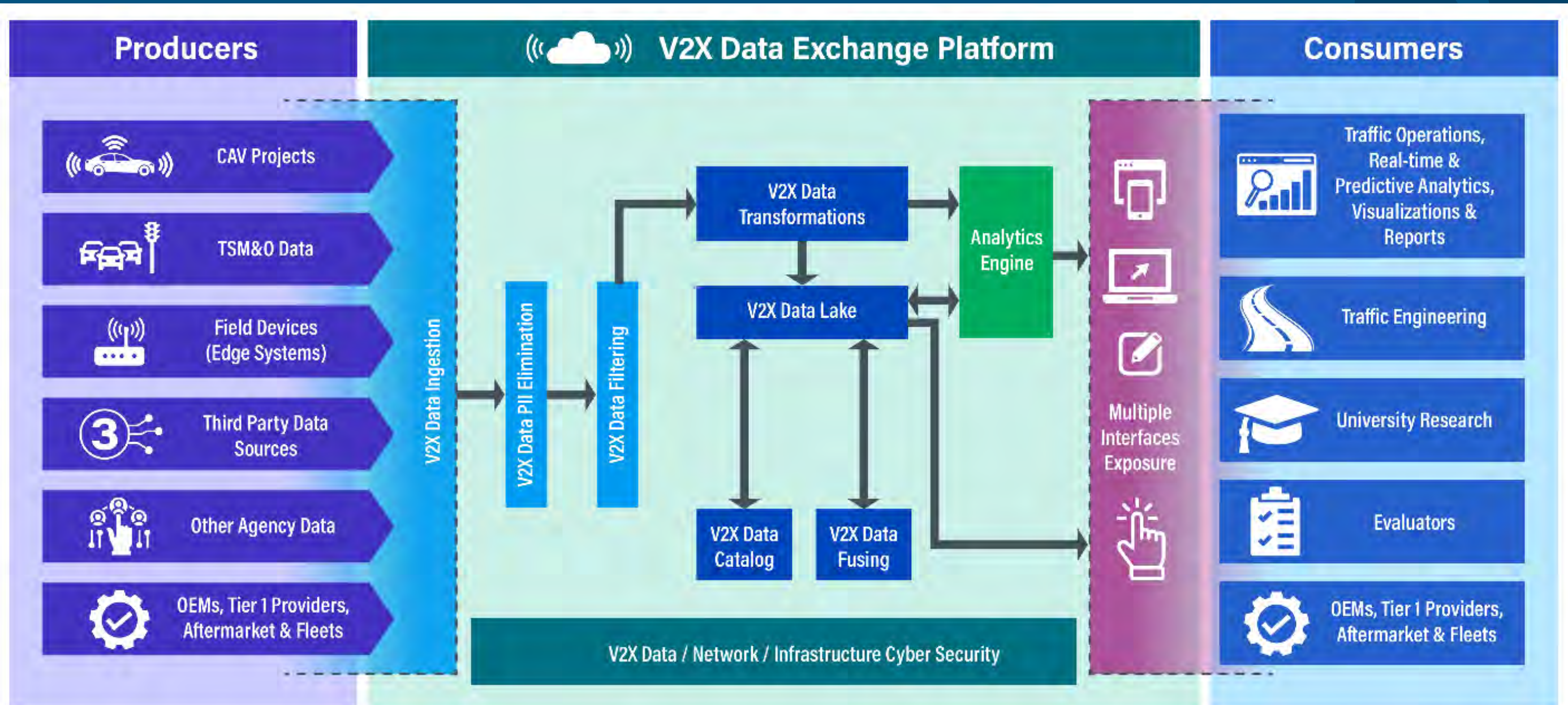
Fig 1. V2X DEP High-level Components from *FDOT V2X-DEP Concept of Operations and Requirements*, 8/11/2023

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FDOT V2X DEP Data Interfaces

- **Ingestion Endpoints**
  - **Aggregated Locally by Forwarder**
  - **Secure site-to-site VPN connection**
    - Agency Networks
    - FDOT's statewide Fiber-optic ITS Operations Network (FION)
- CV Data Framework – the Output API
  - Supports real-time data delivery
    - MAP, TIM, SPaT Messages
  - Supports system integration
    - OEMs, Fleets
    - Cellular-based CV Applications
    - Florida's 511 and 3rd Party Nav. Providers
    - OBU Emulators Presenting TIM alerts and Countdown to Green in Vehicles
- USDOT Workzone Data Exchange (WZDx) API

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Screenshot from *FDOT V2X-DEP Staging Environment* taken 8/30/2024

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Fig 1. V2X DEP High-level Components from *FDOT V2X-DEP Concept of Operations and Requirements*, 8/11/2023

FDOT V2X DEP Graphical User Interfaces

- **Data Lake Explorer**
  - **Interactive Data Catalog**
- Data Query
  - Perform complex queries within the platform
- Dashboards and Visualization examples:
  - Data Ingestion Dashboard
    - Shows which data sets have data, and their date extents
  - RSU Coverage Map
    - Map Visualization of Region where OBU Messages were received
    - RSU radio coverage validation

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Screenshot from *FDOT V2X-DEP Staging Environment* taken 8/30/2024

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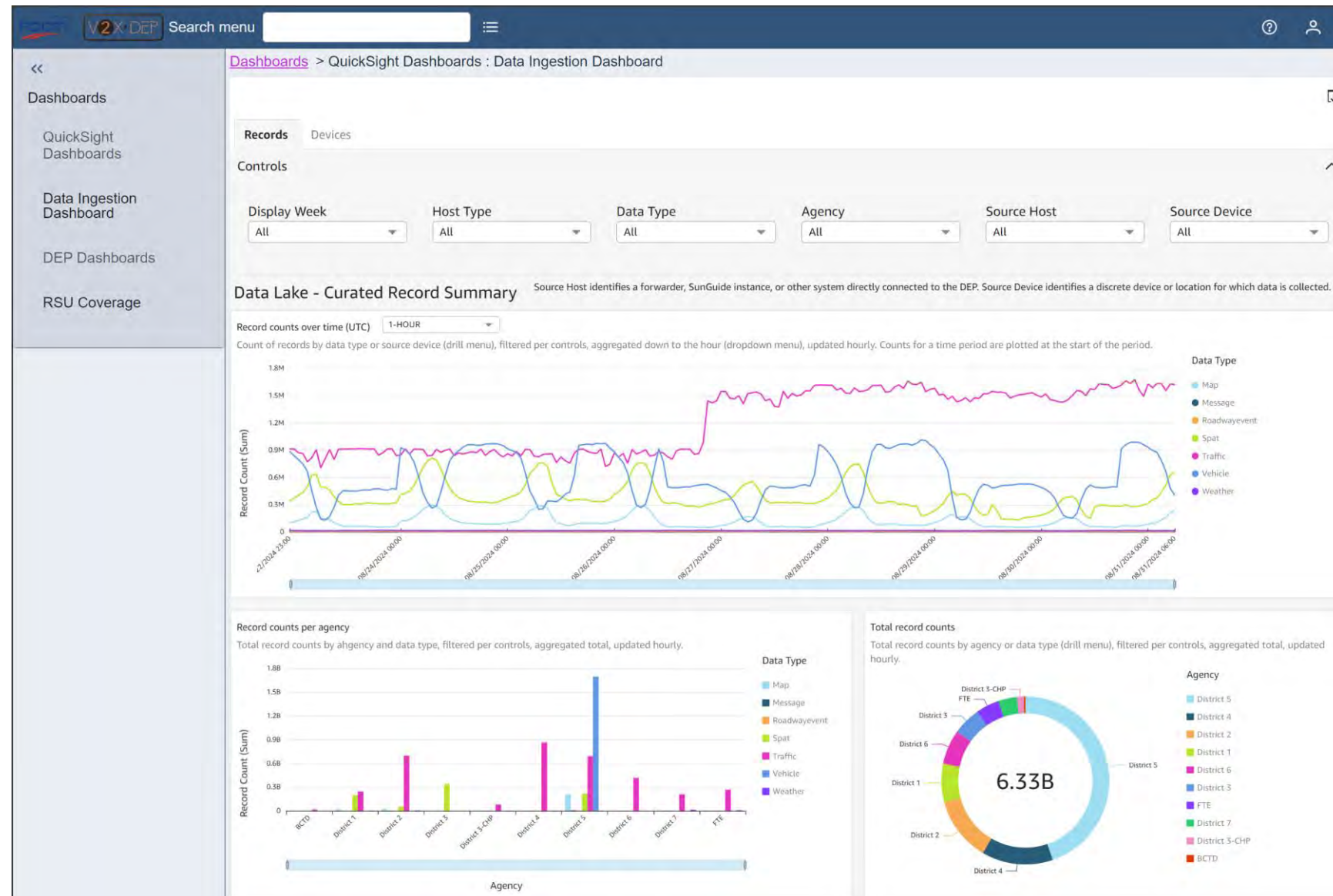Screenshot from *FDOT V2X-DEP Staging Environment* taken 8/30/2024

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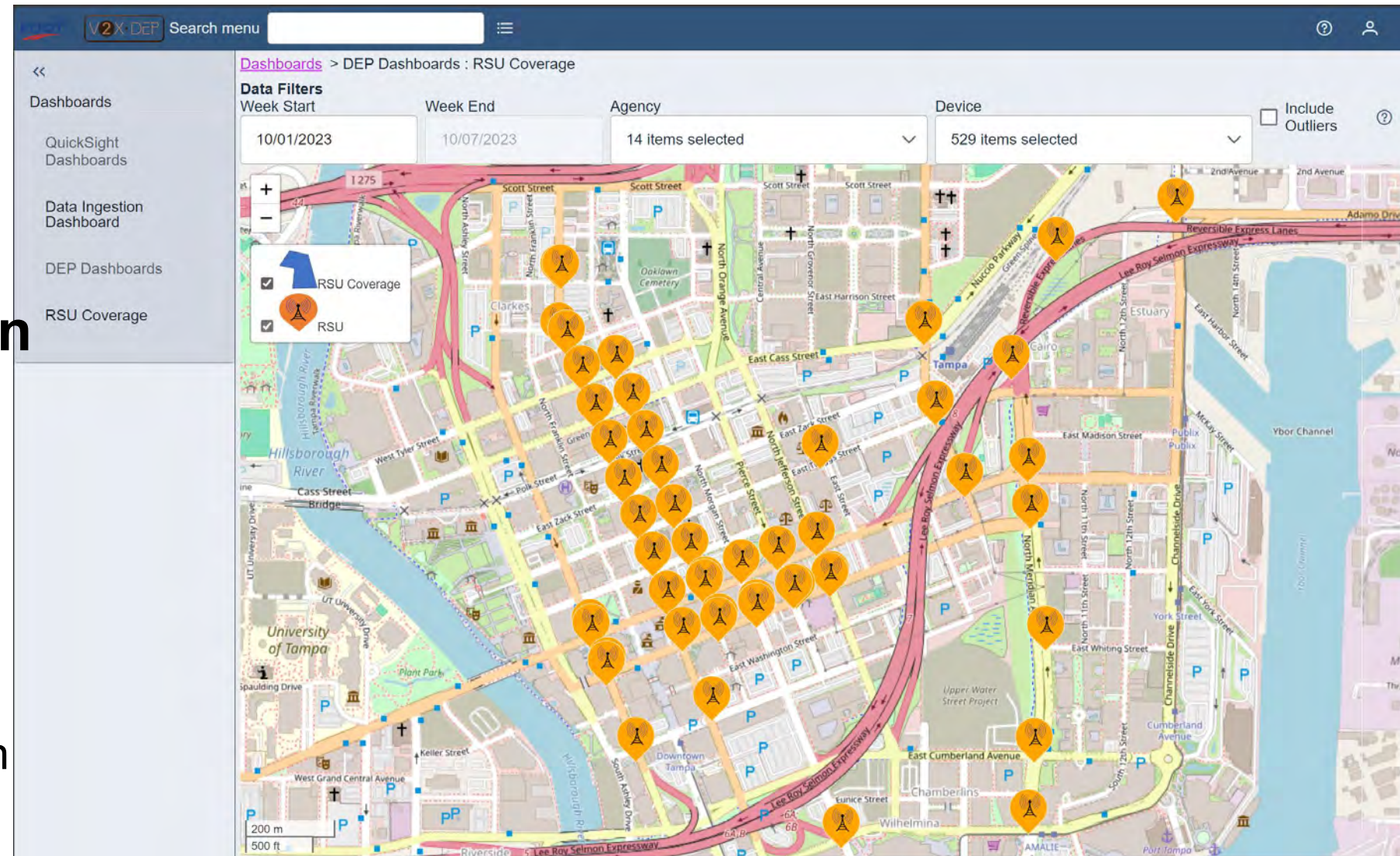   - RSU radio coverage validation

Screenshot from *FDOT V2X-DEP Staging Environment* taken 8/30/2024

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Screenshot from *FDOT V2X-DEP Staging Environment* taken 8/30/2024

FDOT V2X DEP Tie-in to I-4 FRAME

- DEP Integrates I-4 FRAME data
  - Performs Quality Controls
  - Curates into Common Format
  - Combines with other Data Sources
- DEP CVDF Makes Data Available
  - FL511
  - OEMs
  - Navigation App Providers
- OBU Emulation Extends CV Apps
  - Intersections without RSUs
  - Vehicles without OBUs
- ❖ *Extends Benefits Beyond Local Deployment*
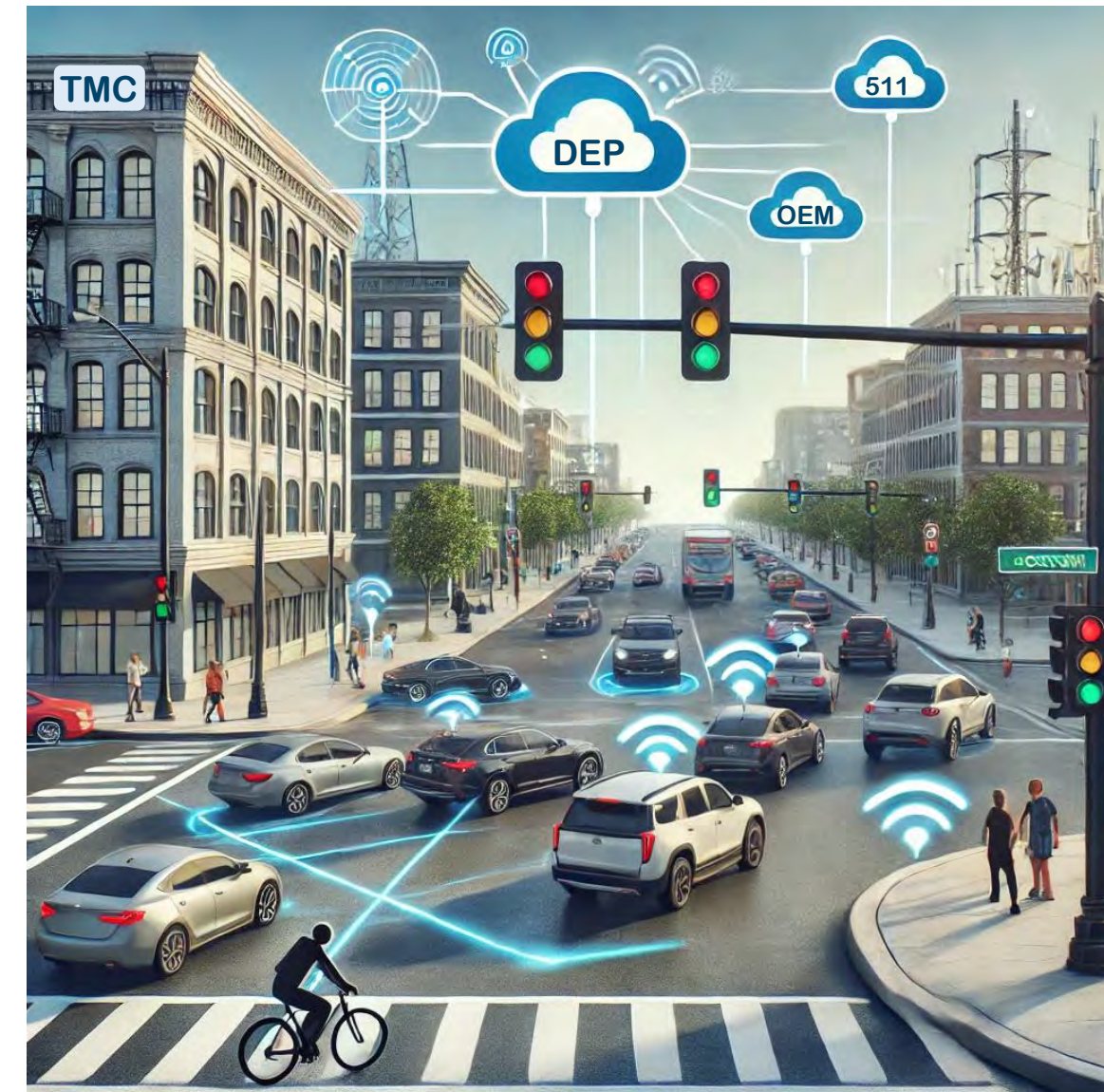
FDOT V2X DEP Current Progress and Next Steps

- Ingesting Data from 10 CV Projects Across Florida

- Traffic Data from Districts 1-7, FTE

  - From SunGuide and other sources, including conditions and events

- Ongoing CV Project Integration

  - As the THEA Pilot Project Progresses

  - As New CV Projects Come Online

- Ongoing Support and Integration with Data Consumer Applications

- Establishing the Digital Infrastructure for CV and Traffic Data
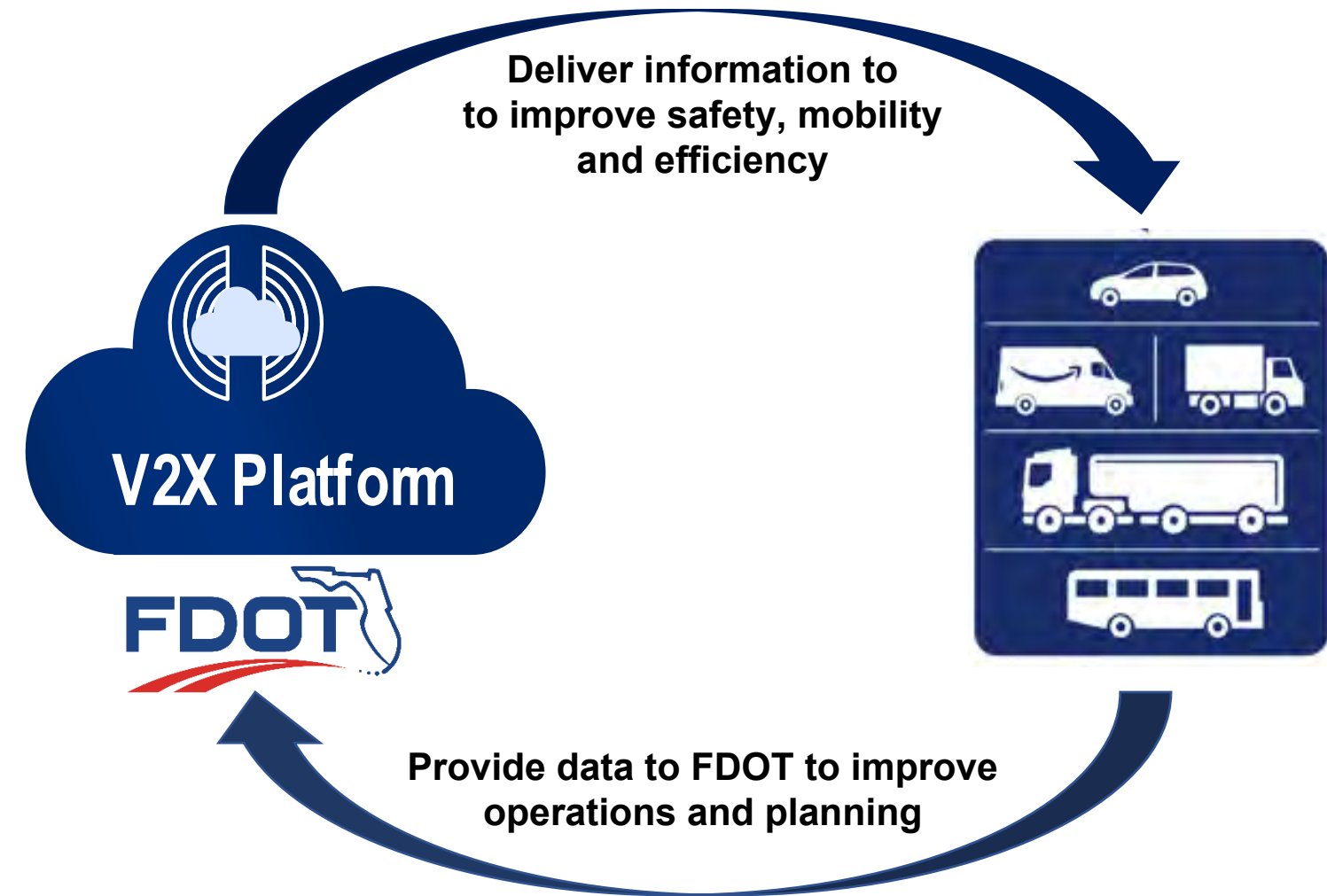
Want to get involved?

FDOT Contacts:

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JoAnna Hand, CPM, FCCM
State TSM&O Software Manager
V2X DEP Project Manager

Support Team:
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- *George Sammit, Southwest Research Institute*
- *Wesley Skillern, Southwest Research Institute*
- *Clay Packard, PE, HNTB Corporation*
- *Omar Faruk, PE, PTOE, HNTB Corporation*

Deliver information to
to improve safety, mobility
and efficiency

V2X Platform

FDOT

Provide data to FDOT to improve
operations and planning

Contact the FDOT DEP team at: **FDOTEXTV2XDEPProgram@dot.state.fl.us**

Thank you

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